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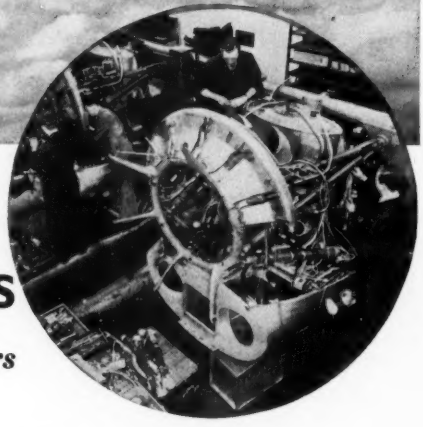

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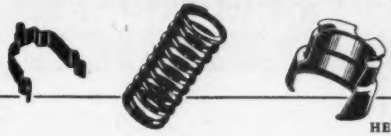

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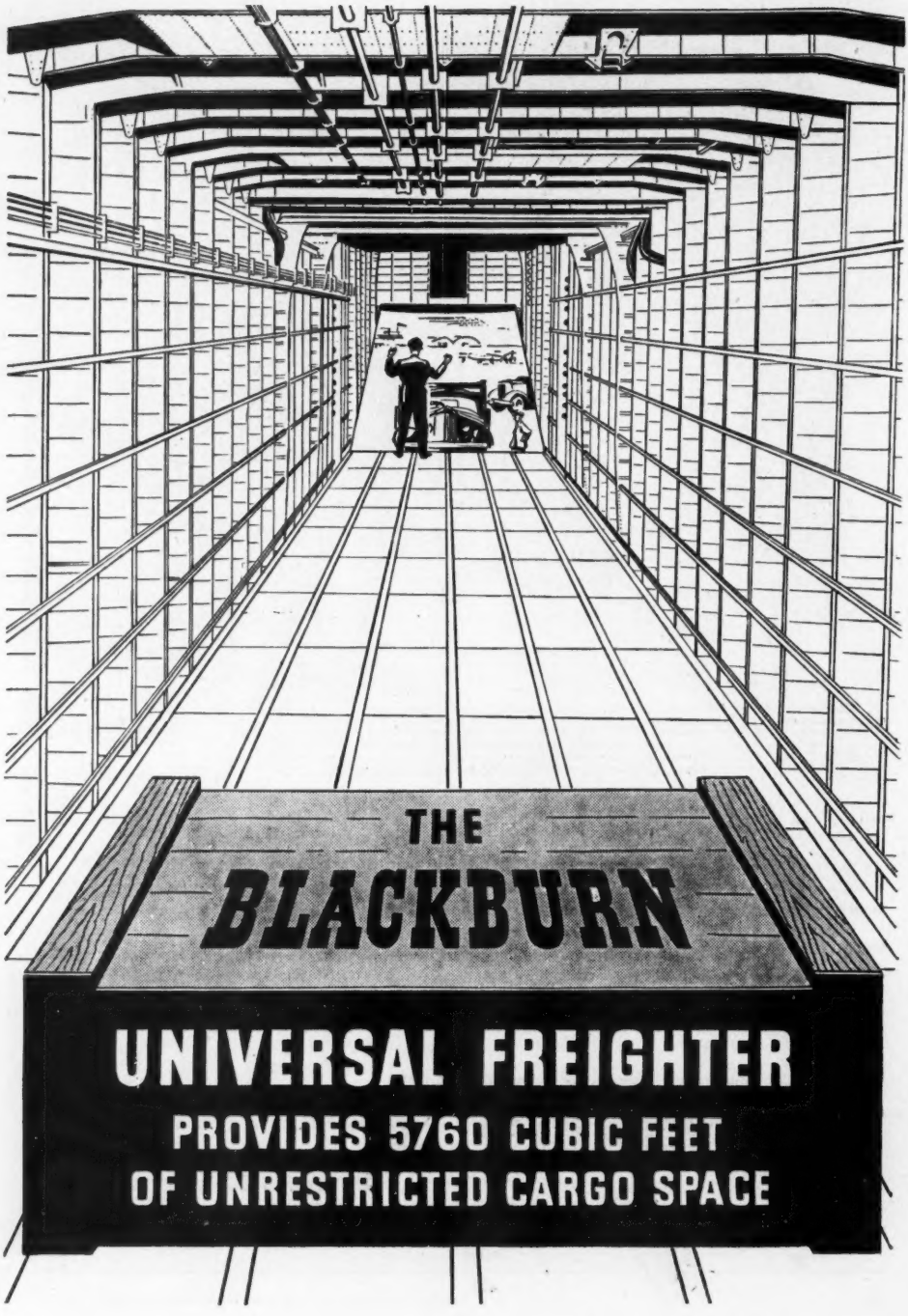
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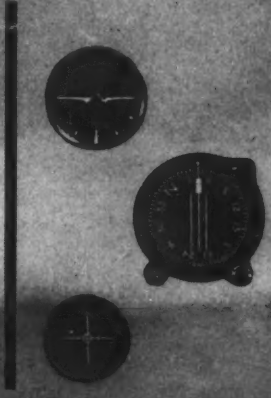

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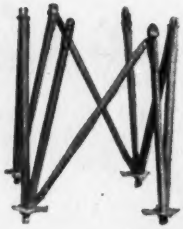

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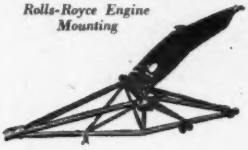

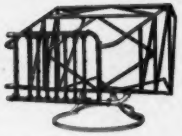

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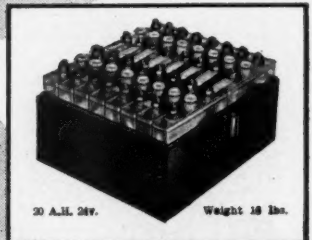

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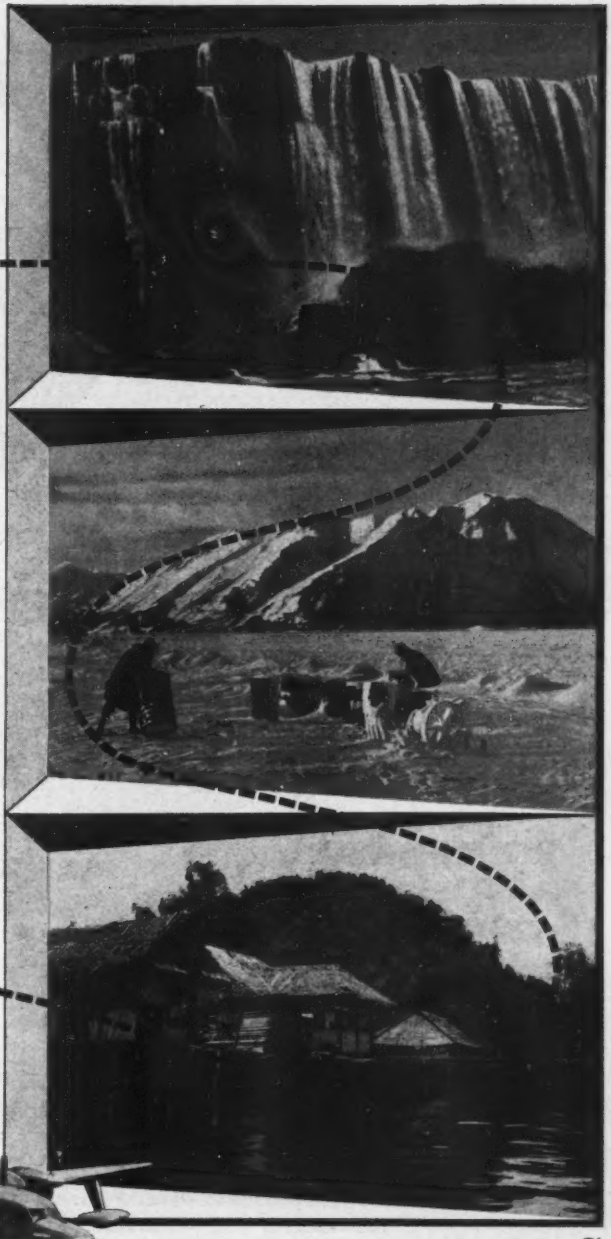

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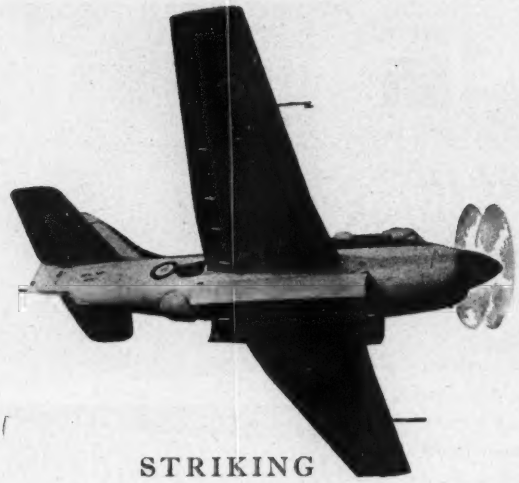

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Founded 1909

No. 2219 Vol. LX. FRIDAY, 3 AUGUST 1951

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
C. B. BAILEY-WATSON, B.A.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

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Wanted—A Brabazon Decision

LAST week saw the Brabazon I giving demonstration flights to a number of people at London Airport, and those who expressed an opinion seemed, on the whole, to have been favourably impressed with their ride. Naturally enough, however, the question was asked: What next? It is accepted that much valuable research has been and will be done with this vast prototype, but that alone is not sufficient to justify its existence or the continuation of work on the developed, turboprop-powered, Mk II.

Although it is over eight years since the Brabazon specification was worked out, the aim in producing such a mammoth is still unrealized in practice—no civil aircraft now flying, with the exception of the Brabazon, is capable of making a direct crossing from London to New York or return with a worth-while payload and with sufficient regularity to operate a schedule service. Certainly, requirements have changed in some respects, but for this one characteristic—the ability to make a direct crossing—the demand is now even greater than it was a few years ago. All passengers grumble when they have to make intermediate stops and turn out, perhaps in bitterly cold weather, in the small hours of the morning. It is these unnecessary landings, too, which contribute to the habitual unpunctuality of aircraft on the Atlantic service.

It is time that something definite was decided regarding the Brabazons and their future. The military requirement suggested cannot be regarded as a primary one in peace-time, and apparently the Princess flying boats are to be taken over for such Service duties as may be found for ultra-large aircraft. After his ride last week, Mr. Strauss reminded interviewers that Comets are being developed for the Atlantic service. But excellent and promising as these pure-jet machines have already shown themselves to be, we cannot help sharing, for the moment at any rate, some of the doubts expressed by Allen Gale on page 144.

Only those in possession of confidential information regarding manpower and materials can say whether it would be wise or even possible at this time to build more than one Mk II Brabazon, but clearly the Bristol company is not alone in wishing to see these aircraft operated in the way that was originally intended. We also should like to see negotiations reopened between the Ministry of Supply and B.O.A.C. in order to discover if a way can be found of operating Mk II Brabazons on passenger services. As for the possibility of war, should it come there is no doubt at all that large numbers of important people will need to be ferried between London and New York.

Well Done, Mutt

"SO Mutt has finally handed over." Such words as these must have been spoken, with a tinge of regret, at well-nigh every airfield and aircraft factory in these islands when Vickers-Armstrongs announced last week that Capt. J. Summers—for 22 years their chief test pilot—had decided to retire from that position. Only those who have worked alongside him can fully appreciate his contribution to Britain's prestige in the air: prestige, that is, not only in the record-breaking sense, but in his furtherance of a tradition of grit and loyalty in a dangerous calling. For Mutt has extricated his sturdy frame from as many tight corners as he cares to remember. There was the flat spin down to 150ft in the first dual Grebe; structural failure in the Hawfinch at T.V. speed; a ride on a spinning Bulldog's centre-section and his subsequent regaining of control by pushing the stick with his foot—all this before he left the Service and joined Vickers in 1929. And his bowler hat was hardly a passport to security, if one remembers the windscreen collapse in the Vireo, the break-up of the M.130, and that most hair-raising of all his experiences, the structural failure of a Warwick, which put on full rudder and ended in a 2,000ft/min side-slip, concussion and a burn-up. But then there were moments which made up for all the spots of bother—the first flight in a Spitfire, the first in a civil jet transport, the first in a turboprop transport, and the first in a British four-jet bomber. Best of all, perhaps Mutt can tackle his new liaison job assured that he has set a manly example for the young fellows who now take over the controls.

Members of the party compare notes after landing at St. Mary's, in the Scilly Isles. Probably the first landing there by any four-engined monoplane, the arrival of a possible successor to the Rapide was obviously appreciated by the local inhabitants. "Flight" photograph

HERON In the Air

A Typical Day's Work for de Havilland's New Feeder-Liner

By THE EDITOR

No. 43 of the Series

THERE is no better way to obtain a quick and fair assessment of a new aircraft than to fly it on a job typical of its intended operational role. Such an opportunity came my way recently when it was decided to fly the de Havilland Heron to the Scilly Isles for the day, there to make full-load take-off and landing trials.

Passengers, full fuel tanks and ballast brought the take-off weight up to the full 12,500 lb permitted to date, and the opportunity was taken to fly under simulated operational conditions and measure actual fuel used, for comparison with calculated figures. (In the event, they worked out at almost exactly the quoted 39 gal/hr. The tanks held 183 gal.)

A promising though initially grey morning found a cheerful party ready for embarkation and take-off from Hatfield, and the Heron's four Gipsy Queen 30s started up readily, ran up satisfactorily, and were soon trundling us across the grass towards the runway at considerable speed. The idling power of all four engines makes for over-fast taxying, and two would probably be considered sufficient on the ground. However, the brakes are smooth and very powerful and I was on this occasion the better able to judge the good springing of the Heron's fixed landing gear.

The cockpit is very similar to that of the Dove—well laid out, offering a very good view, but a little on the small side for maximum comfort and large officers. Seat and pedal adjustment ensures comfort and freedom for the operation of controls.

It is understood that there will be some minor rearrangement of dials in the subsequent Herons—this story is concerned with the prototype—but, in general, radio, oil-cooling gills and primers are to be found on the port-side cockpit wall; flap indicator, engine synchronizer, and air pressure dials are on the panel to the left; flying instruments ahead of the captain; engine dials central, and main radio, fuel gauges and ignition switches ahead of the 1st officer. Fuses and additional radio controls are on the starboard side.

A central pedestal carries power and flap levers and a gate for an undercarriage lever when a folding undercart is fitted. Trimmers, fuel cocks and starter buttons are also to be found here, and between pedestal and panel are the autopilot selector and trimmer. Radio aids can be supplied according to the customer's requirements; the prototype carries V.H.F., radio compass, beam and, recently fitted, a fan-marker receiver.

The Heron's throttle levers are of particular interest, combining as they do the functions of power, pitch and mixture controls. An all-mechanical cam system has been evolved which is very simple and efficient. In practice, as the lever is advanced, power and r.p.m. increase until full throttle is reached; then, further movement fines the pitch still more and increases r.p.m. Mixture strength is adjusted automatically according to manifold pressure. The Queens are, of course, unsupercharged.

A handy instrument is fitted to help in synchronizing the four engines. Using No. 1 port outer as the master, the other three are synchronized by watching, in turn, the three small "paddle-wheels" on the face of the instrument. If they are turning anti-clockwise the power lever should be advanced and vice versa. When all engines are synchronized—a condition readily recognizable by ear—the three wheels are stationary.

The Heron was duly lined up and I sat-in for the first take-off, which saw us airborne well before the 500-yard mark on the long runway. Mr. Jamieson was at the controls, I was beside him, and Mr. Geoffrey Pike and other passengers relaxed in the cabin. There were apparently no swing tendencies, acceleration was pronounced, and there was little to be done in the way of pulling-off.

A pleasant and informal atmosphere was created for the flight when, in the absence of course or suitable map, we headed "that away"—the captain pointing roughly towards Venezuela. Later, when cloud persisted below, we checked position by the coastal outline as indicated by cumulus tops. In addition, with a six-penny piece as screwdriver, the inoperative radio compass selector-box was removed and reoriented with the aid of Brookmans Park behind us. From then on, it served admirably until the promised clear skies and bright sunshine were encountered over Exeter.

A climb of 400ft/min had been selected from take-off to the 8,000ft cruising level (max. s.l. rate of climb is 1,200ft/min). This required 2,200 r.p.m., and 155 m.p.h. I.A.S., reducing to 120 m.p.h. at the top height. The mean true air-speed was

The short runway, shown left to right in this aerial view of the airfield, was used for the first landing. Note the position of the control buildings and the short stretch of tarmac at the runway end. Using the runway seen stretching from the engine cowling to the top left-hand corner, the Heron was airborne on a practice take off (see right-hand photograph) by the time it had reached the control building, leaving nearly half the length in hand.

150 m.p.h., and the distance covered during the climb, 50 miles.

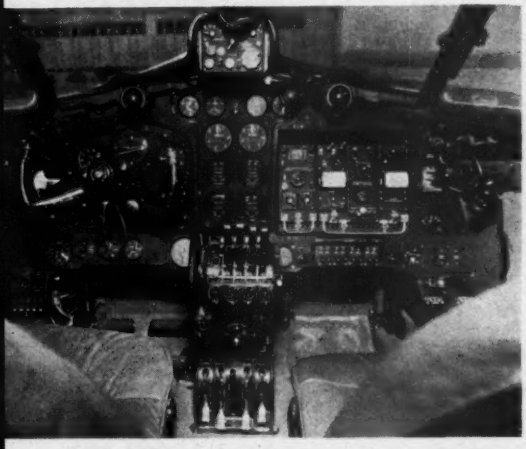
Having levelled off, 65 per cent take-off power was set with 2,100 r.p.m., this being a compromise between speed and a.m.p.g. requirements. The air temperature was rather higher than standard and the T.A.S. worked out at 165 m.p.h. This was, of course, with fixed landing-gear and full load. Max. w.m. cruising speed at 3,000ft, incidentally, is quoted at 177 m.p.h.

For part of the time the autopilot was allowed to do the work, but I also took the controls for long spells to get used to the aircraft. I liked the feel of the controls very well; in particular, the ailerons are crisp yet not over-light. In a baby four-engined airliner of this type they are most suitable for the job. If correctly trimmed, the Heron shows no tendency to wander when flown hands-off, although it is rather sensitive to fore-and-aft trim and movement of passengers.

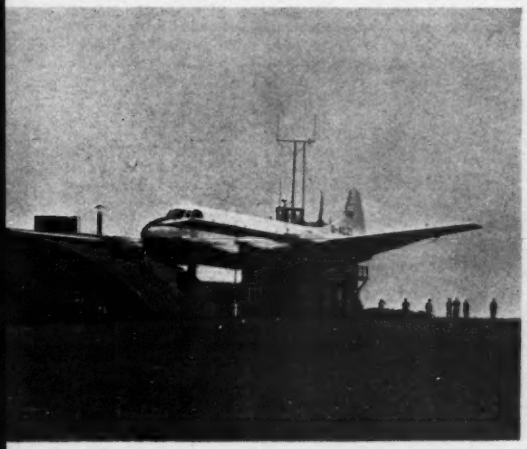
Noise is not excessive, in spite of their being four ungeared engines near to the cabin. I had, in fact, expected more noise and vibration. Others on board confirmed that the ride was very comfortable and the view out excellent.

On reaching Land's End, it was just possible to make out a hazy shape on the horizon, which I was told would be the Scilly Isles. A slow descent had already been commenced, the rate selected being 300ft/min, and the mean true airspeed 165 m.p.h. Engine speed had been reduced to 1,800 r.p.m.

The group of five inhabited and several other small islands looked delightful as we approached, and it was hard to believe that they were not some tropical atoll. The small lagoons appeared intensely blue or green according to their position in relation to the sun, and the golden sand of small bays contrasted with dark rocky beaches and out-crops dividing them.



Very similar to that of the Dove, the Heron cockpit offers an excellent view. Instruments are identified in the accompanying story.



The airfield looks very small indeed—as in fact it is—and, as we got lower down, the slope of the runway we selected looked almost precipitous on both sides of the central hump. The *Air Pilot* says the slope varies between 1 in 21 and 1 in 25.

We made an approach on 098, which is 560 yd long and mostly grass, but finishes with 100 yd of tarmac reaching almost to the cliff edge. An 8 kt wind was roughly in the right direction

For the first landing, Jamieson brought the Heron round the last turn at about 100 m.p.h., keeping the approach fairly wide and low. He then motored in straight at about 90 m.p.h., reducing to just about 80 m.p.h. at the boundary. With the minimum of elevator movement the Heron then flew-on gently, tail down, and stopped easily by the crown of the hill. The air photograph shows the runway concerned running from left to right, and a 90-deg turn to the left brought the Heron to its parking point beside the control building. The outward journey took 1 hour, 55 minutes.

A practice take-off was made later on runway 331 which starts steeply uphill and is 625 yd long. The Heron was off in under half the length, as may be judged from the second photograph with the control building behind the aircraft.

After a pleasant lunch and a swim from Tresco Island, we took leave of St. Mary's and set course eastward. I changed over to the captain's seat and flew to Hurn for refuelling. Without any fear of appearing to be over-confident I can say that the Heron is very easy to handle. The flight to Hurn was pleasant and uneventful and, with occasional briefing from Geoffrey Pike, I made a conventional, fairly wide circuit and approach. For the turn-in I was advised to maintain about 100 m.p.h. with take-off (gated) flap setting. This 20-deg position can be selected when speed is below 155 m.p.h. There is a quite pronounced trim change as the flaps go down. Once aiming for the runway, a steady 90 m.p.h. was held and full flap selected (115 m.p.h. top limit). The approach angle was then quite steep, and the view excellent. The flaps move down slowly and the elevator trimming wheel is both handy and effective.

When the time came to level out, a very small backward movement on the control wheel brought the Heron into landing attitude and it sank on gently in its own time. It felt steady and under full directional control, even though the nosewheel was held off for some distance. The brakes were barely necessary on the long Hurn runway, but a trial application showed them to be smooth and powerful. The flight back to Hatfield was without incident.

As fuel checks were being made and we were carrying passengers, it was not convenient on this occasion to try any three-engined flying or stalls. However, it can be stated that, on take-off, safety speed at full load is 91 m.p.h. for critical engine failure. The climb on three is then 400ft/min with the dead airscrew windmilling in fine pitch, and flaps at 20 deg take-off position. Continuing with flaps up, airscrew in coarse pitch and the good engines at max. continuous power, the climb is at the rate of 595ft/min. This figure compares with the max. continuous climb on four engines of 1,125ft/min. With regard to stalling, the flaps-up figure is 89 m.p.h., with 20 deg of flap it is 79 m.p.h., and with full flap 71.5 m.p.h.—all at 12,500 lb.

For manœuvres involving full application of aileron or rudder a speed limitation of 147 m.p.h. I.A.S. is imposed and, for the time being, the "never exceed" speed is 190 m.p.h., though on tests this has been greatly exceeded. Centre-of-gravity limits have been fixed at 6.35in forward and 8.35in aft of the datum.

The cost figure for the Heron of £37,200 is made up as follows: airframe, £24,700; four engines at £2,300 each; four airscrews at £275 each; radio, £2,200. Engine overhaul life is 800 hr.

In spite of the fact that the aircraft approaches more nearly the current international requirements than does the Rapide now handling Scilly traffic, it is unable to meet them entirely. Thus the demonstration of its ability to take a full load in or out of the island's airfield with a large safety margin does not mean that it could be licensed to do so. The Heron, at 12,500 lb, will meet British Civil Aviation Regulations for aircraft in performance Group A, and will comply with I.C.A.O. Category A. At 12,000 lb a.u.w. (in British Group C), the Heron clears 50ft in still air from grass in 650 yd, and lands in 450 yd, using airline technique. Regardless of the technique, it will clear 50ft in 450 yd. This compares with Rapide standards.

Examination of operators' requirements has satisfied the de Havilland company that production is justified and several Herons, some with retractable gear, should be flying by the end of the year.

The opening for Herons seem to be in two classes. In undeveloped areas they could replace Dakotas which have only been possible to operate to date because of their very low cost as surplus after the war, and which are now in some cases operating with only 30 per cent load factor. A second promising market seems to be among operators of Doves and Rapides who have developed a few routes with success and now need a larger but unelaborate aircraft, capable of flying from second-class airfields.

FROM ALL QUARTERS

The S.B.A.C. Display

THE S.B.A.C. Exhibition and Display at Farnborough will be open to the public on Saturday, September 15th, and Sunday, September 16th. Prices of admission are as follows:—

Pedestrians 3s. (children 2s.); cyclists 4s.; motor cycles 5s.*; cars £1*; motor coaches £5 and £10.* Special cheap day tickets will be obtainable on British Railways, Southern Region. The gates will be opened at 10 a.m. and the flying display will start at 3 p.m. each day. For further admission information and advance booking, application should be made to Auto-Parks, Ltd., 1, Maclise Road, Olympia, London, W.14.

* *Any size, including all occupants.*

Polar Lincoln

IN connection with the training programme of the R.A.F. Flying College, Manby, Lincs, five Lincolns have recently conducted navigational training flights in the Arctic Circle. One of these aircraft, the *Aries III*, flew from Keflavik, Iceland, over the North Pole to Fairbanks, Alaska, in 18 hours 5 minutes. The other four made circular flights from Keflavik to Shannon Island (Greenland) across to Disko Island off the west coast of Greenland, and back to Iceland.

The 3,533-mile flight to Fairbanks was made in Arctic daylight, and although the weather at the North Pole was reported to be dry, icing was experienced after leaving Keflavik, and just before reaching Fairbanks.

The captain of the *Aires III*, W/C. R. T. Frogley, is the senior instructor at the college. The crew included S/L. J. L. Mitchell, S/L. T. C. Imrie, F/L. A. D. Jillings, F/L. D. F. Grocott, F/L. R. M. Hamilton, F/S. R. E. White and Cpl. B. Rowden. At the time of going to press it was learned that the return flight had been delayed by engine trouble.

W/C. D. C. McKinley made a similar flight over the North Pole in a Lancaster, *Aries I*, in May, 1945.

Airmet in the House

WHAT he believed to be a petition with the fewest number of signatures ever to be presented, was brought before the House of Commons by Mr. G. P. Stevens (Conservative, Langstone) on July 26th. "The petition," said Mr. Stevens, "is for the restoration of the Airmet weather-broadcasting service. The total number of signatures is eight only. They are learned and expert Societies who find that the Airmet service was of immense value not only in the production of food, but in the preservation of life. . . . They are aware of the difficulties of congested wavebands, but they believe that by some rearrangement the introduction immediately of one hundred per cent accurate weather forecast is possible, and certainly will be possible with the selective system of frequency modulation."

Mr. Stevens added that the petition was signed by senior officers of the Royal Meteorological Society, The Royal Agricultural Society of England, The National Farmers Union, The Air League of the British Empire, The British Air Line Pilots' Association, The British Gliding Association, The Institution of Navigation, and the Geographical Association.

Canadian Expansion

TWO new links in the lengthening chain of Canadian defence production will result in greatly increased output of fighters and turbojets. Chatco Steel Products, Ltd., of Tilbury, Ontario, will begin very shortly to build major components—rear fuselage sections, tailplanes, rudders, fins and tail cones—of the Avro Canada CF-100. Between 800 and 1,000 workers will be recruited from the Windsor district, where the labour market is already seriously overcrowded as a result of mass lay-offs at Ford and other automotive companies.

The second development, brief reference to which has already been made in *Flight*, concerns Rotax Canada, Ltd., which will employ about 600 workers on the manufacture of fuel systems and accessories for the Orenda turbojet. For this purpose a 2½ million dollar factory will be erected on a 20-acre site at Scarborough. The one-storey building will allow 104,000 sq ft of floor space.

Meanwhile, at Malton, headquarters of the Avro Canada organization, the largest engine factory in Canada is taking shape on a property north-east of the company's present premises. By early 1952 Orenda turbojets for the CF-100 should be in production.

Sir Henry Tizard to Retire

CHAIRMAN of the Advisory Council on Scientific Policy at the Ministry of Defence, Sir Henry Tizard, G.C.B., A.F.C., F.R.S., F.R.Ae.S., F.Inst.P., is shortly to retire from that post. From the time of the First World War, in which he served in the R.F.C., Sir Henry has had a distinguished career in aviation research; he was chairman of the Aeronautical Research Committee for ten years, from 1933 to 1943.

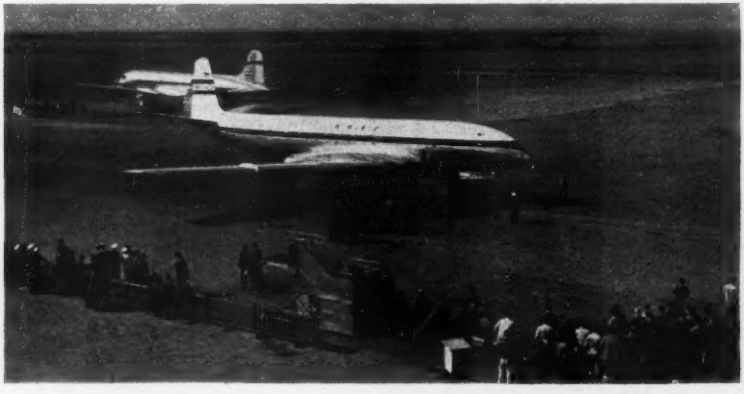
Speculative reports in London newspapers this week—which the Ministries of Defence and Supply would not confirm—named Sir John Cockcroft, now Director of the Atomic Research Establishment at Harwell, as Sir Henry's successor.

Canberra Items

AN English Electric Canberra B.2 tactical bomber will attempt to establish a record for the east-west Atlantic crossing towards the end of August. The flight will be officially observed and timed by the Royal Aero Club on behalf of the F.A.I., and the Canberra's crew of three will be headed by W/C. Roland Beamont, chief test pilot, English Electric. As yet, there is no official record for the flight, but the fastest time was set up by a Canberra piloted by S/L. A. E. Callard on February 21st this year. In face of severe headwinds, the crossing from Aldergrove, Northern Ireland, to Gander, Newfoundland, was made in 4 hr 37 min.

Brief details are now available of the U.S.A.F. night-intruder version of the Canberra, designated B-57A and built under licence by the Glenn L. Martin Company. This model will have fixed forward-firing guns, a tail-housed braking parachute, and provision for a considerable number of bombs smaller than those normally carried by the R.A.F. Canberra. The fuel tanks will be modified to take the American JP-3 fuel, and the power plants are likely to be of the Curtiss-Wright J-65 type, alias Armstrong Siddeley Sapphire.

Already 90 per cent of the drawings required at the Martin factory have been despatched from England and Martin are now



JO'BURG VISITOR: From Palmietfontein Airport (owned and administered by South African Railways) comes this view of B.O.A.C.'s Comet G-ALZK; it was secured on July 18th, just before Capt. M. R. Alderson and his passengers prepared to disembark after flying from London to Johannesburg via Cairo and Entebbe —a distance of 6,212 miles —in 17 hours 33 minutes. As reported on page 154, the aircraft was delayed by minor technical trouble but returned to London last Sunday.

IN THE CIRCUIT: As it prepares to land at Brough, the General Aircraft G.A.L.60 military freighter is clearly seen against the shining waters of the Humber. Features to note are the bogie undercarriage and the new fairing on the nose-wheel oleo. It will also be observed that the ventral entry ramp and doors have been refitted after load-dropping tests.

hiring a new labour force which, on the Canberra project alone, may eventually total 8,000. The cost of tooling will be over ten million dollars. A report from America expresses the opinion that production will be rapid because the Canberra is "the quintessence of simplicity"; nevertheless, a number of alterations to American standards will be necessary.

Aircraft Storage Out-of-doors

FIRST demonstrated in this country four years ago by R. A. Brand and Co., Ltd., the "Cocoon" process of protecting aircraft components for long-term storage has been successfully applied to complete aircraft, and official trials—in which machines up to transport size will be treated—are about to be conducted at R.A.F. establishments. Aircraft which have been thus protected can be safely stored out of doors, and tests made at the Winterization Experimental Establishment in Canada, and at Khartoum and Singapore, have proved the utility of the process in climatic extremes. As is well known, also, the U.S.A.F. and U.S.N. have employed similar methods for many years.

The procedure for airframes is basically similar to that for components, which are initially covered with a web of gossamer-like filaments formed from a viscous compound applied with a spray gun. One or more coatings of a second preparation are then sprayed on the web, forming an airtight skin which envelops the whole component. In the case of complete aircraft, only openings need be covered by the web, the skin compound being applied direct to unbroken surfaces; a special coating to protect Perspex and paint from the solvent used is, however, employed first.

Though tough in texture, the skin can be stripped off without difficulty when the aircraft or component is taken out of storage.

The process—which has been used for some time past by exporters of jet and other engines—can clearly be of great value in storing a reserve of aircraft without occupying valuable hangar space. It is handled by the "Cocoon" division of R.A. Brand and Co., Ltd., at Field House, Breams Buildings, London, E.C.4.

A National Model Aircraft Rally

FROM all parts of the United Kingdom aero-modellers will converge at Fairwood Common airfield, Swansea, on August 5th and 6th for the "Festival Year" British National Model Aircraft Rally. This will be the first occasion on which the Rally has been held outside England. A large part in organizing the event has been played by the South Wales area of the Society of Model Aeronautical Engineers.

THE "DAILY EXPRESS" RACE

FIFTY-ONE entries have been received for the second race for the *Daily Express* Challenge Trophy, which is being flown this year from Shoreham Airport, Sussex, on Bank Holiday Monday, August 6th. This international handicap contest is being run over a 186-mile course from Shoreham along the coast to Newhaven Lighthouse, then across country to Whitstable in Kent and back to the finishing line at Brighton West Pier.

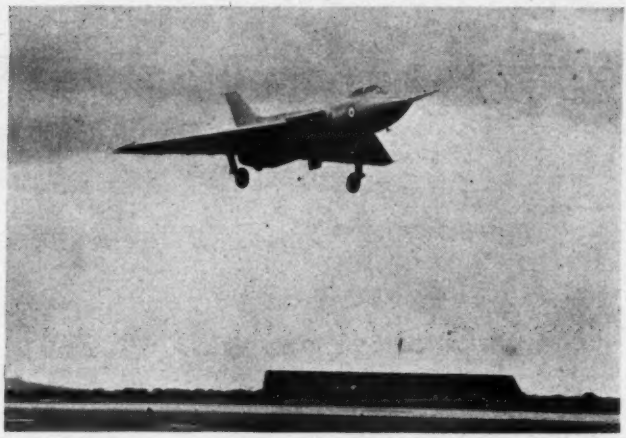
Many well-known racing pilots will be recognized in the list of entrants which we reproduce below. Five of the six members of the Throttle-Benders Union are included; they are Tony Cole (Comper Swift); Fred Dunkerley (Gemini); Ron Paine (Miles Hawk Speed Six); S/L. James Rush (Miles Falcon-Six); and Nat Somers (Gemini). Three women pilots have also entered: Mrs. "Peggy" Grace will fly a Taylorcraft Plus D; Miss Lettice Curtis is piloting her Wicko G.M.1; and Mrs. Zita Irwin is in the Windmill Theatre's Percival Proctor. The fastest aircraft entered is the Spitfire 22, flown by Jeffrey Quill, O.B.E., A.F.C., test-pilot to the Vickers-Supermarine Company, while at the other end of the speed scale there is the 1931 Avro Avian, piloted by Capt. R. E. Gillman.

Foreign competitors taking part include an S.A.S. pilot, Capt. Jan Christie, of Norway; L. C. Marmol, the well-known Czech sailplane pilot; Jean Lignel, the French designer (flying one of his own machines); J. G. Garnier, of France, in a Norécrin; P. Genin, of Switzerland, flying a Bonanza; and G. A. Ferrari and Count Leonardo Bonzi, both of Italy, each flying one of the new Italian Ambrosini S.7s.

The winner of the race will receive the *Daily Express* Challenge Trophy and a cash prize of £1,000. The second and third prizes are £500 and £250 respectively. The race is due to begin at 1430 hrs on August 6th, and after completing the course the competitors will return to Shoreham Airport.

Racing No.	Entrant	Pilot	Aircraft and Registration
7	H. M. Kendall ...	Entrant ...	Chilton D.W.1 (G-AFGI)
16	Capt. R. J. Crossfield	Entrant ...	Auster Autocrat (G-AJEK)
19	D. D. Dempster ...	Entrant ...	Chilton D.W.1 (G-AESV)
21	R. G. Pilkington ...	Entrant ...	Auster V (G-AJVT)
22	P/O. D. Norman ...	Entrant ...	D.H. Moth Major (G-ADHE)
27	T. W. Hayhow ...	Entrant ...	Auster Aiglet (G-AMIH)
28	E. W. Westbrook ...	Entrant ...	Miles Messenger IVa (G-ALBE)
29	S/L. J. A. R. King, A.F.C.	P/O. M. R. T. Chandler	Miles Hawk Trainer III (G-AKRH)
30	F/L. P. Raymond, D.F.C.	Entrant ...	Miles Hawk Trainer III (G-AKRW)
31	G. Marler	Entrant ...	Miles Falcon-Six (G-ADTD)
33	R. Matthews-Naper	Entrant ...	Miles Messenger IIa (EI-AFH)
37	H. J. G. Turner ...	Entrant ...	Miles Hawk Trainer (G-ALFE)
40	Capt. J. H. Christie	Entrant ...	Klemm K1 35D (LN-OAV)
42	W. T. S. Buchan ...	Entrant ...	D.H. Moth Minor (G-AFRY)
44	A. E. Coltman ...	Entrant ...	Miles Hawk Major (G-ADMW)
48	Miss E. L. Curtis ...	Entrant ...	Wicko G.M.1 (G-AFJB)
50	W. P. I. Fillingham ...	Entrant ...	D.H. Moth Minor Coupé (G-AFOJ)
51	Mrs. D. M. I. Cole ...	A. L. Cole ...	Comper Swift (G-ABUS)
52	E. Ross	Entrant ...	Miles Hawk Trainer III (G-AITO)
62	L. C. Marmol	Entrant ...	Percival Proctor III (OO-INT)
63	J. T. Basnett... ...	Entrant ...	Miles Hawk Trainer III (G-AIUE)
65	A. J. Whittemore and Co.	R. A. Peacock	Percival Proctor III (G-AMGE)
67	H.R.H. Prince Alexander of Yugoslavia	Entrant ...	Percival Proctor I (G-AGWV)
68	E. Day	Entrant ...	Miles Hawk Trainer III (G-AKRV)
70	Eagle Aviation, Ltd.	J. H. Sauvage	Percival Proctor I (G-AHES)
71	R. Blackburn, O.B.E.	H. Wood ...	Percival Proctor I (G-AHVG)
73	A. S. K. Paine ...	Entrant ...	Percival Proctor I (G-AHNA)
75	V. Van Damm ...	Mrs. Z. Irwin	Percival Proctor V (G-AIET)
76	D. J. Bennett ...	Entrant ...	Percival Proctor V (G-AHGR)
78	J. P. Crowther ...	Entrant ...	Percival Proctor III (G-AKWV)
80	W/C. R. H. McIntosh	Entrant ...	Percival Proctor I (G-AIEB)
81	D. J. Bennett ...		Percival Proctor III (G-AMCO)
82	W. W. Lyle	Entrant ...	Percival Proctor I (G-AHDJ)
83	B. G. Heron ...	F. C. Fisher	Miles Monarch (G-AIDE)
85	J. G. L. Lignel ...	Entrant ...	S.F.C.A. Lignel 46 (F-BCZJ)
86	J. G. Garnier ...	Entrant ...	Nord 1203 Norécrin (F-BEBL)
87	P. Genin	Entrant ...	Beechcraft Bonanza (HB-ECS)
89	Hon. M. A. R. Cayzer	Entrant ...	Miles Aries I (G-AHDJ)
90	J. N. Somers ...	Entrant ...	Miles Gemini III (G-AKDC)
92	S/A. I. ing. Ambrosini	G. Ferrari ...	S.A.I. Ambrosini S7
93	R. Crewdson ...	I. A. Forbes	Miles Nighthawk (G-AGWT)
94	F. Dunkerley ...	Entrant ...	Miles Gemini Ia (G-AKKB)
95	S/L. J. Rush	Entrant ...	Miles Falcon-Six (G-AECC)
96	R. R. Paine	Entrant ...	Miles Hawk Speed Six (G-ADGP)
97	Personal Plane Services	H. E. Scrope	Percival Mew Gull (G-AEXP)
98	Count Leonardo Bonzi	Entrant ...	S.A.I. Ambrosini S7
100	Vickers-Armstrongs, Ltd.	J. K. Quill	Vickers-Supermarine Spitfire 22

HERE AND THERE



WELL AWAY: W/C. R. Falk gets off smartly from Boscombe Down for one of the early test flights of the Avro 707A delta-wing research aircraft, ground views of which were published last week.

R.Ae.C. Awards

THE Royal Aero Club announces that A. Cdre. Sir Frank Whittle has been awarded the Gold Medal of the Fédération Aéronautique Internationale for his work on development of jet power plants. The Louis Blériot Medal for 1950 goes to Mr. R. R. Paine, of Wolverhampton Airport, for attaining a 100-km closed-circuit speed record of 192.83 m.p.h. last year. His mount, of course, was the familiar Miles Hawk Speed Six.

Stand from Under . . .

A BULLDOZER (weight 9½ tons) has been successfully parachuted from a Fairchild C-119 Packet of the U.S.A.F. The first heavy-cargo drop of this kind, incidentally, is claimed to have been made at Wright-Patterson Air Force Base in 1946, the subject being a one-ton field gun.

Willing Horse

PILOTS of the U.S.A.F. 16th Troop Carrier Squadron (Assault) interpreted the word "accelerated" literally by completing 276 hours' flying during the three-week accelerated service - test programme scheduled for a single Chase C-122 twin-engined assault transport. In one week 115 hours' flying was logged, and on several days the C-122 was airborne for more than 20 hours.

Professor Heinkel on the Mig

THE famous German aircraft designer, Professor Ernst Heinkel, who now owns a small farm-tractor factory outside Stuttgart, is of the opinion that the Russian Mig-15 fighter is the work of Siegfried Gunther, with whom he worked closely for more than ten years. The professor claims to recognize the style of Gunther in various design features. Gunther is known to have worked for the U.S. Army at Landsberg in 1945. His subsequent offer of his services to the U.S. authorities is said to have been refused, and in April, 1946, after he had moved to Berlin, he was taken to Russia with his wife. Professor Heinkel believes that Gunther is now working at Kalinin, near Moscow.

Braking Turboprops

ON July 23rd, the Mamba-Marathon made the world's first landing using turbo-prop braking airscrews. The aircraft was flown by D. de Villiers, chief test pilot of de Havilland Propellers, Ltd., and the landing was made at Hatfield. The airscrews were of D.H. manufacture.

Canadair Wins

AN UNSPECIFIED number of T-36 aircraft has been ordered by the American government from Canadair Ltd. Announcing this, Mr. John Jay Hopkins, chairman and president of Canadair, revealed that the type would also be produced for the Royal Canadian Air Force. The T-36 is an entirely new design of twin-engined trainer-cum-transport, and Mr. Hopkins states that the order marks the first occasion on which the U.S.A.F. has placed a contract of such magnitude outside its own borders.

Civil-Defence Helicopters

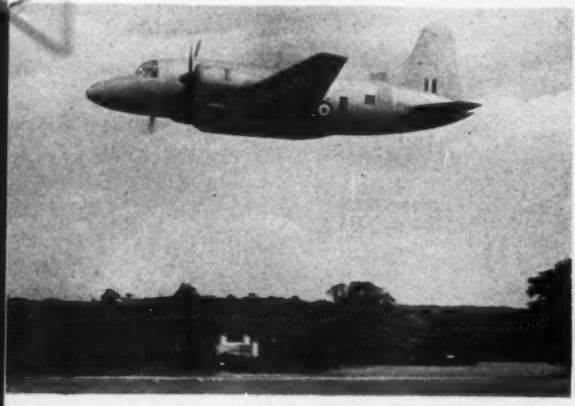
MR. GEOFFREY DE FREITAS, Parliamentary Under-Secretary for Air, announced in the Commons on July 26th that the use of helicopters for civil defence is under consideration by the Home Office. It is evident that rotary-wing aircraft would be invaluable for reconnaissance, rescue and communications work.

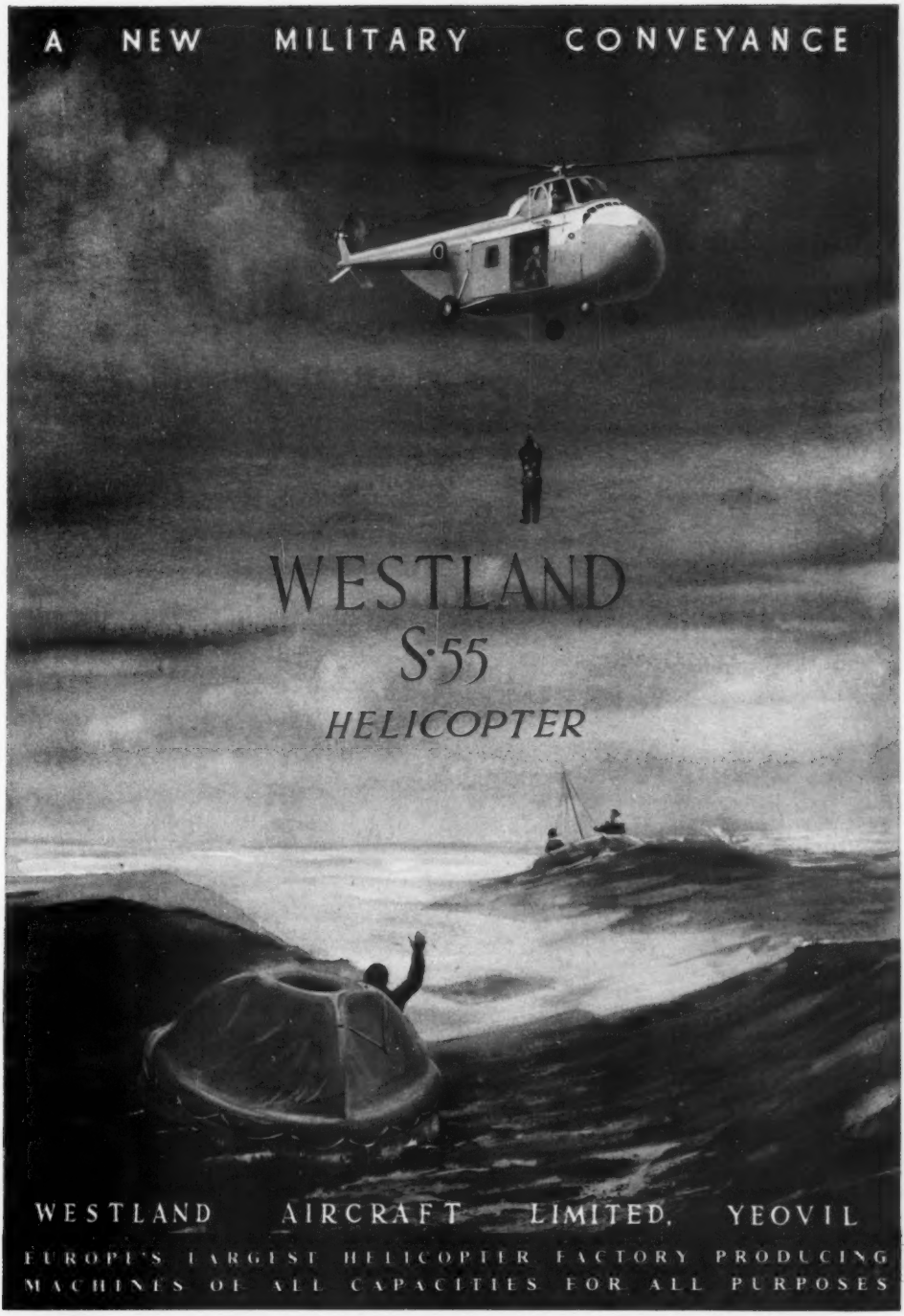
Ambulance Service Cancelled

THE R.A.F. Ambulance Service between Korea and Britain has been cancelled as a result of the Persian crisis. All available aircraft of R.A.F. Transport Command have been concentrated in Middle East airfields for the evacuation of British subjects from Persia.

TWENTY-FIVE YEARS of test-flying was completed by Capt. J. ("Mutt") Summers, O.B.E., of Vickers-Armstrongs, on July 27th. To mark the occasion he made a routine test flight in a Varsity trainer (left) and subsequently received the congratulations of his colleagues G. E. Lowdell, A.F.M. (left), and G. R. Bryce, with whom he is seen. Capt. Summers is now chief liaison officer and Mr. Bryce (right) is chief test pilot.

"Flight" photographs

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EUROPE'S LARGEST HELICOPTER FACTORY PRODUCING
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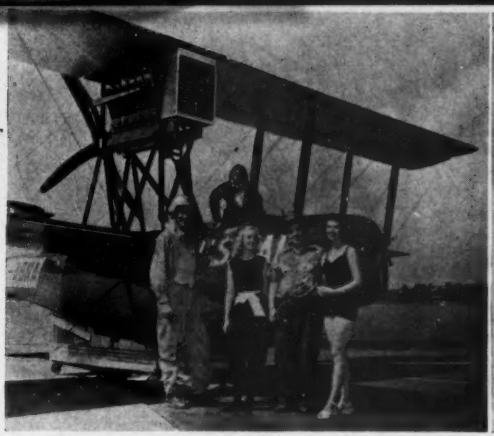
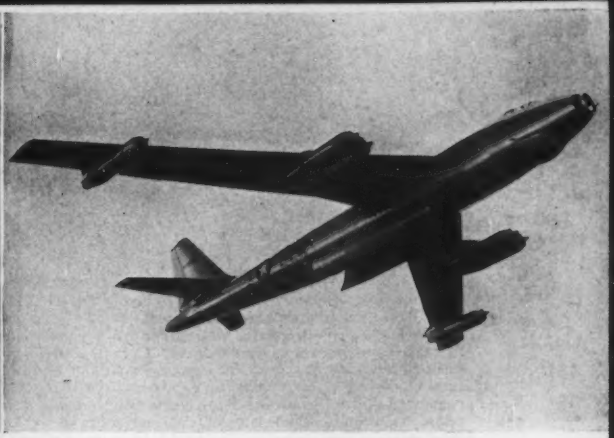
Operators of the Viscount gain appreciably by its high utilisation factor. The Viscount's freedom from vibration eliminates a host of minor troubles and reduces the ground work per flying hour.
THE VICKERS VISCOUNT
FOUR ROLLS-ROYCE DART PROPELLER TURBINE ENGINES





BOEING LOOKS BACK—AND AHEAD: The first Boeing-designed aircraft was the B-1 flying-boat, seen with test pilots and bathing belles of yesterday and today and with Mr. "Nick" Carter, who worked on the original in 1919 and who lately supervised its rebuilding for the company's 35th anniversary celebrations. With bomb doors open on the right is Boeing's latest, the B-47 Stratojet. Mr. Edward C. Wells—Boeing's vice-president, engineering—said recently, "One must define what is a bomber and what is a missile. Does the word missile mean flight without crew? If it does, then the bomber could fall into this category, for the trend is in the direction of automatic flight and navigation controls."

HERE AND THERE . . .

Off the Beam?

"THE film shows the work of Air Traffic Control, the organization responsible for keeping all aircraft safely roving on their charted courses . . ."—from the Press announcement of a new C.O.I. film *In On the Beam*, the subject of a review in *Flight* of July 13th.

Quiet, Please

R.A.F. officers have visited Farnborough (Kent) Hospital following complaints that low-flying jet aircraft have disturbed the patients. A report to the Bromley Group Hospital Management Committee states that special identification marks may be painted on the roof as a warning against low flying.

Australian Sabres

IT is now confirmed that, as suggested in *Flight* of July 6th, Rolls-Royce Avon turbojets will be installed in the North American F-86 Sabre jet fighters to be built under licence by the Commonwealth Aircraft Corporation in Australia. To enable manufacture to begin quickly the North American company has agreed to supply a large quantity of manufactured components.

U.S. Expansion

GENERAL Marshall, the U.S. Secretary of Defence, has stated that the U.S.A. is building towards an aircraft production capacity which will be able to sustain a 180-group air force. The General made it clear, however, that he was referring to production *capacity* and not production.

Shepherding A Stray

CAPT. William R. Peters, of the 31st Fighter Escort Wing, stationed at Manston, has been recommended for the Air Medal for courageously going to the assistance of an R.A.F. pilot whose Anson was lost over the Channel. While on a weather reconnaissance flight on March 2nd, Capt. Peters was requested to make a search and his commanding officer describes how Peters, disregarding his own personal safety, found the Anson and guided the pilot safely to Manston.

Royal Prescience

ADDRESSING the Royal Commission on Awards to Inventors in London on July 23rd, Sir Edward Appleton, F.R.S., Vice-Chancellor of Edinburgh University, said that the radio system used in 1924 research into the ionosphere would give the presence of an aircraft and its speed, but not its position. Sir Robert Watson-Watt had had the vision to stake his own reputation on development and had given up his normal life. Sir Frank Smith, F.R.S., a former director of scientific research at the Admiralty, said that the first suggestion he had ever heard for the detection of aircraft by radio came from King George V. Sir Frank was sorry to have to tell the King that he did not know at that period of a receiver sufficiently sensitive or powerful.

Spanish Air Minister In U.S.A.

GENERAL Eduardo Gonzalez Gallarza, the Spanish Air Minister, has commented in Madrid on his recent trip to America. He gave as his opinion that the U.S.A.F. is the greatest guarantee for peace in existence, adding that the Spanish Air Force could, within a short period, be brought up to the level of any other air force. General Gallarza stated as Spain's primary need ample economic assistance to develop her aircraft industry. While in America General Gallarza spent a fortnight visiting airfields and aircraft plants as the guest of the U.S. government.

Machine-Tools on Show

TO meet the shortage of machine tools in the United Kingdom, the Ministry of Supply has ordered from Western Europe, during the 12-month period ended June, 1951, machine tools to the value of £40 million. An opportunity now exists for prospective buyers to see some of these at the European Machine Tool Exhibition, to be held in Paris from September 1st-10th. Both German and Italian manufacturers are expected to be strongly represented, but, due to its heavy commitments, exhibits of the British machine-tool industry will be represented only in token form.

THE SIGN OF SCORPIO: A Northrop F-89 Scorpion all-weather fighter of the U.S.A.F. "ripples" a salvo of rocket projectiles (16 of which are carried beneath the wings) during trials at Muroc. Built-in armament of the Scorpion is six 20 mm guns.

IN BRIEF

Sir Graham Cunningham, chairman and managing director of the Triplex Safety Glass Co., Ltd., who recently toured America as head of a team of British industrialists to study the conservation of scarce materials, has stated that British and U.S. industrialists have pooled ideas.

* * *

The irritating problem of eliminating dust specks during finishing operations has been tackled by J. C. Spray Finishing Systems, who announce that tack rags are now available for demonstration. Inquiries should be forwarded to 5, St. James' Place, London, S.W.1.

* * *

Mr. James Allen, special assistant to the Reconstruction Finance Corporation, has been elected to the board of the Glenn L. Martin Company. Mr. Allen has had an extensive career as a government official and as a management and public relations consultant.

Commercial Aviation Commentary

By ALLEN GALE

No. 3 of a New Series

CURRENT reports suggest that the Comet powered with the Rolls-Royce Avon is certain to be operating on the North Atlantic within a year or two. Some pessimists have tried lately to decry this aircraft and have pointed out that the version at present used by B.O.A.C. in their development of a Middle East and Far Eastern jet-airliner route is turning out to be something of a problem. Where such rumours originate is a matter for conjecture, but it seems certain that de Havillands and B.O.A.C. are not responsible. Whilst no detailed technical information has been disclosed, one gathers from casual conversations that to date the Comet is doing its stuff according to plan, and that the end of this year will see the introduction of a regular service.

What, then, of the ultimate Atlantic plans? Even assuming that the aircraft is all that it is said to be, it would seem that the Ocean, or at least the northern section of it, will be especially tough for an aircraft powered with jet engines. It is no secret that the North Atlantic is a commercial proposition today only because the operators are allowed a great degree of flexibility in the routing of their aircraft and because they have considerable latitude in their choice of altitude and the concomitant winds.

How far the same degree of flexibility in the choice of routes and the selection of altitudes will extend to the Comet is the main question. It seems to me that with an inherent necessity for high-altitude operation this aircraft is liable to be up against some almost insuperable problems. Winds of 100 kts and much higher at altitudes above 20,000ft are quite a common feature of this route; and although it is an accepted fact that the upper winds do tend to decrease in intensity above the tropopause it does not appear that the Comet is equipped to cruise in the stratospheric layers. At the same time it will be unable to file a flight plan at a medium level (10,000 ft or so) in the same manner as its piston engined counterparts, since its fuel requirements at such heights are exorbitant. Thus it will have no alternative but to take what is the most unfavourable height. Undoubtedly, on many occasions this will mean that a direct flight will be an impossibility and thus a routing *via* Iceland or the Azores will become necessary. The point here is that whilst aircraft in use on this route today find themselves faced with the same situation, it happens only now and again. With the Comet, in winter, it seems likely that it's going to happen most of the time—to the extent that serious consideration will have to be given to the possibility of scheduling the aircraft through the Azores or Iceland. If this is done the entire operation will depend on the weather at one or, possibly, two airports; and present statistics indicate that this dependency will cost the operator dear in terms of reliability.

It may be that I am unduly pessimistic about the Comet's chances on the North Atlantic, but the combination of winter weather on the other side, with its ice and snow, fog and gales, and the upper wind condition affecting the fuel reserve position as it does, the whole operation may be rather tricky. B.O.A.C. certainly have their problems.

◆ ◆ ◆

I SHOULD like to compliment Peter Masefield on the calibre of his "Chief Executive's Page" in the *British European Airways Magazine* each month. Too often house-journals pass up their unrivalled opportunity to get useful information over to the employees and, instead, concentrate on social gossip and rather casual journalistic efforts from various members of the staff. From the material contained between such covers one can glean about as much knowledge of what is happening in the company concerned as would fill a couple of sentences—and not very long ones at that. B.E.A.'s journal, on the other hand, as well as containing all the aforementioned matter which is apparently so necessary, strikes a new note with its centre pages carrying a message from the chief executive. This gives at first hand (to take a recent issue as an example) such illuminating data as a monthly progress report, with comparisons between last year and this, the current situation concerning the airline's aircraft replacements (which appear to be a little late this year), news about the very serious pilot-shortage, the policy behind the recruitment of radio operators and some inside information about a recent strike. With such a journal as this to tell him about domestic matters, and *Flight* to keep him informed on wider issues, no airline employee can have any excuse for ignorance of aviation matters in general.

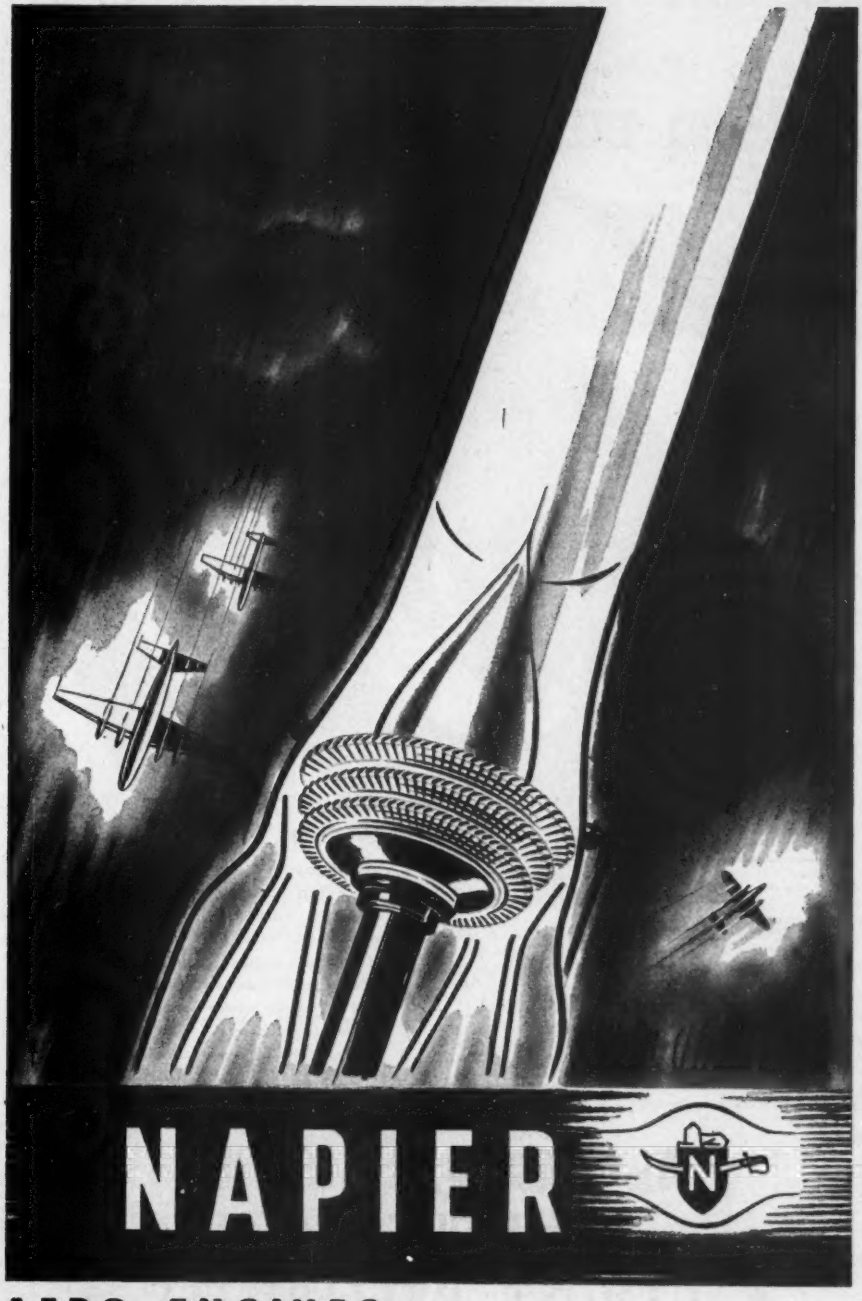
◆ ◆ ◆

WITH the long-awaited terminal building at London Airport not so far away, one can begin to wonder how it is going to turn out. For some reason the plans (if they yet exist in any concrete form) have been shrouded in Ministerial gloom and, so far, one has not been allowed an inkling of the intentions. Mind you, this is probably just as well, because if there is one situation which alters from month to month it is the requirements for terminal buildings at international airports. It is difficult to think of one such edifice which is entirely adequate for existing traffic, let alone for future commitments.

Part of the trouble lies in the fact that it is extremely difficult to budget for the number of aircraft to be handled at one and the same time. Airliners have an unfortunate habit of tending to bunch up on their arrivals; one moment the ramps are almost clear and the next there are ten aircraft taxying up. Departures are more easily controlled, but in bad weather it happens sometimes that even they are held on the apron pending departure clearance. The number of trains that a railway station can handle is directly related to the number of tracks entering it and it is impossible for the maximum to be exceeded. No such safeguard protects the airport management and they are compelled to admit as many aircraft to their terminal as can safely be landed by the controllers. On this score alone it is very difficult to plan a building which is adequate, yet at the same time is not uneconomically vast.

From the little that one has been able to glean about London's new terminal it would seem that the congestion in entering the place by ground transport may rival that often experienced by the air traveller. The use of a tunnel is mandatory where the runways are linked together in such a manner that they form a square or oval and the terminal is planted in the middle; but one wonders if future developments will not indicate the desirability of separating at least two runways so that a dual highway can enter the area on the surface instead of under it. From my own observations I would say that an awful lot of vehicles proceed to and from international terminal buildings, and one has visions of a long queue down the Bath Road awaiting entry into the airport tunnel whilst a thin trickle filters out of the other end into the congested area of the departure and arrivals sections.

One other point which requires mention is the fact that, so far, most terminals have been constructed on the utopian theory that airliners arrive and depart on schedule. Without wishing to do the airlines any disservice one must comment that, regrettably, this is not always the case and that occasionally passengers are committed to a long and dreary wait whilst some technical or meteorological hitch is unravelled. If the planners of our new terminal are realistic enough to admit this, we shall have a building in which it is a pleasure to spend the waiting hour. There will be cinemas—not only for news but for full-length features, there will be day-and-night nurseries with nannies to help overburdened mothers, there will be rest quarters for elderly and ailing people, there will be showers and baths and dressing rooms, shoeshine parlours or machines, beauty shops, and writing rooms. There will, in fact, be everything to help the restless traveller so that, far from cursing the delay, he will find it a welcome respite from the swift rush of air transport.



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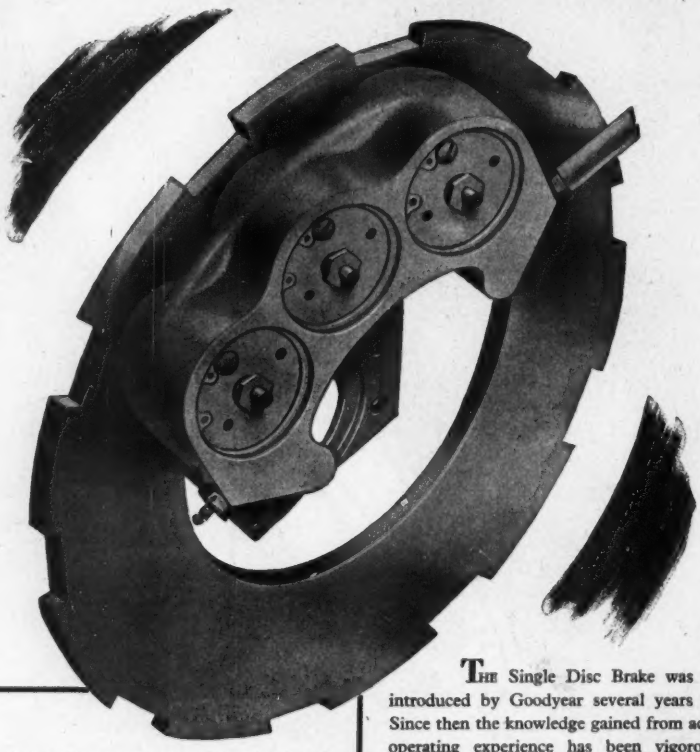

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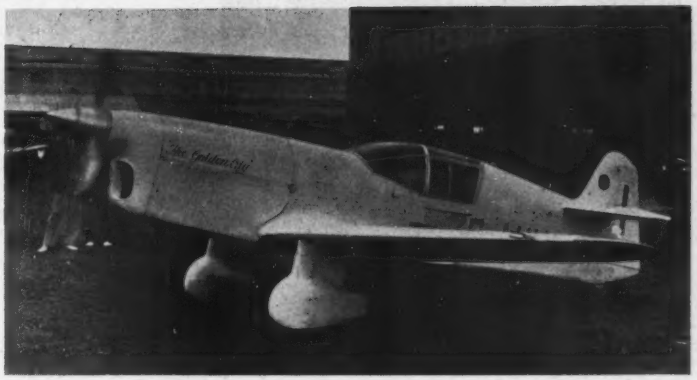

With Ratier electric airscrew and bearing the South African registration, ZS-AHM, the Mew Gull, "The Golden City," may be described as being in her first heyday—although she met with ill-fortune in the Schlesinger South Africa race.

By
H. E. SCROPE
and
D. F. OGILVY*

LIFE OF A THOROUGHBRED

The History of a Famous Mew Gull: Henshaw's Great Achievements: Notes on Handling Characteristics Today

IT was in 1934 that Captain Edgar Percival, founder of the Percival Aircraft Co., as it then was, built a small single-seater high-performance aircraft largely to carry out experiments with a new wing section in which he was interested. This aircraft—the first Mew Gull—also had the makings of an ideal racing machine, for it was the first British light aircraft to have a speed in excess of 200 m.p.h.

It may be said that the Percival P.6 or Mew Gull was a descendant of the Hendy 302 low-wing monoplane, the design of which was the combined work of Captain Percival and Mr. B. Henderson. The Gull followed intermediately, and of the several produced by Percival Aircraft, at Yate, near Bristol, some were fitted with a Napier Javelin engine, as was the prototype Mew in its original form. Later, a Gipsy Six 1 was installed, but this first aircraft, registered G-ACND, was somewhat ungainly in appearance and was not entirely successful. The following year, it was rebuilt with a completely re-designed fuselage, tail unit and undercarriage, and for a time a French Regnier engine was fitted.

After this, four production models were constructed, in which several improvements were introduced. The second of these four was G-AEXF, completed in 1936 in time to take part in the £10,000 Schlesinger race from Portsmouth to Johannesburg. To make it more suitable for long-distance racing, the aircraft was equipped with a French Ratier airscrew and long-range internal tanks, which increased the petrol capacity from the standard 41 gallons to 79 gallons. Bearing at that time the South African registration ZS-AHM and the name *The Golden City*, it was entered in the race by Mr. Len Oates and flown by Major Allistair Miller, but trouble with the fuel feed system enforced an emergency landing in a small field 30 miles short of the first control point at Belgrade. The fault was overcome, after some delay, and Miller flew on to Belgrade where, however, he decided to withdraw from the race.

Alex Henshaw—considerably the worse for wear—is assisted from the cockpit after his remarkable record England-to-the-Cape and return flight.

A few days later, the aircraft was flown back to England where it was registered as G-AEXF and sold to Mr. Bill Humble. It was not long, however, before he parted with it to the owner with whom it will always be associated, Mr. Alex Henshaw.

With a D.H. Gipsy Six 1 and a fixed-pitch airscrew, Henshaw raced it with consistent success throughout 1937. During that year, he won the Folkestone Trophy at 210 m.p.h., and in other races he gained one second place, two third places and three prizes for the fastest speed. But he had bad luck in the King's Cup when he was forced to retire at Stoke-on-Trent with water in the fuel. For the same reason, a few hours previously, he had had an uncomfortable experience when the engine temporarily cut out over the Irish Sea.

Throughout the following winter, the Mew was worked on by Mr. Jack Cross of Essex Aero, Ltd., in an effort to improve its performance still further. A Gipsy Six R, taken from one of the original Comets, and a Ratier airscrew were fitted. The engine cowling was re-designed, the top cover being raised slightly, and a special type forward-facing air-intake was introduced. The ram effect at maximum speed coupled with the pressure rise resulting from the intake being brought close behind the airscrew, actually created a manifold pressure of ½ lb at full throttle under favourable atmospheric conditions at sea level. The undercarriage was removed and considerably altered to take Dunlop wheels in place of the original Palmer units and small trouser spats were designed with steel fairing strips which actually rubbed on the tyres. The lower decking of the fuselage was also re-designed and altered slightly in shape.

Thus mounted, Henshaw gained second place in the 1938 Hatfield-Isle of Man Race at a speed of 247.5 m.p.h., and third place in the Manx Air Derby at an average speed of 239 m.p.h.

After these races, in preparation for the 1938 King's Cup, Henshaw decided to have the top of the fuselage aft of the cockpit lowered by about four inches. A one-piece moulded windscreen and modified canopy were then fitted. The cockpit was literally tailored to fit his body, and even though the seat was merely a thin

* *Mr. Hugh Scrope is the present owner; Mr. David Ogilvy tested the aircraft after overhaul and provided these handling notes.*

Mr. Alex Henshaw, who did so much to make the Mew Gull famous.

LIFE OF A THOROUGHBRED . . .

cushion on the floor of the cockpit, the top of his head touched the canopy.

The engine was completely dismantled and new-type pistons were fitted. As a British-made airscrew had to be used in the King's Cup, it was necessary to remove the Ratier and fit a D.H. two-pitch type with 11-degree range. This involved a major modification, for to instal this type on the Gipsy Six R engine necessitated an extension to the front of the crankshaft. During previous tests at full throttle the thrust bearings had overheated and caused some hasty landings so that any further loading in this connection created a certain amount of anxiety. However, a special billet of high tensile steel was ordered from the English Steel Corporation and the intricate job was machined with the greatest care to Cross's design. The chief worry during the actual race was the fear of excessive gyroscopic loading on the shaft during cornering.

All this, however, was well worth the effort, for Henshaw won the race for the King's Cup at the record speed of 236.25 m.p.h.; a record which is still unbeaten today. But perhaps the greatest surprise was the fact that G-AEXF proved to be faster than the E3H Mew Gull flown by Captain Percival, the scratch machine which had been prepared with all the customary backing of an aircraft manufacturing concern.

Long-distance record breaking in light aircraft was the aim of many pilots in the 1930's and Alex Henshaw was no exception. He chose to attempt the London-Cape Town-London record then held by a Comet.

His small Mew was essentially a short-range racing aircraft, and was thought by many to be unsuitable for such a flight. But somehow Jack Cross found a way of increasing the petrol capacity to 87 gallons, which gave a range of close on 2,000 miles, even though it made the cockpit more cramped than ever. The instrument panel had to be moved several inches nearer the pilot's face, and a reserve tank, holding six gallons, was positioned in the cockpit between and around his legs. The oil capacity was doubled by designing and fitting an ingenious saddle-tank over the front of the engine crankcase, the top forming part of the outer skin of the aircraft and, at the same time, a cooling surface.

A less powerful standard Gipsy Six II replaced the Gipsy Six R, and a constant speed unit was added for the airscrew. For night flying, a navigation light, operated by a lever in the cockpit, was made to pop in and out of the fuselage behind the pilot. To comply with the regulations for crossing the Sahara, Henshaw had to carry a radio transmitter for use on the ground in the event of a forced landing. This he placed in the locker behind his head. He had to find room as well for his parachute, maps, refreshments and all the essential documents he had to carry.

On December 5th, 1938, to try out the long-range capabilities of the machine, he carried out a test flight of some 1,600 miles from Gravesend. Assisted by a tail-wind, he passed Paris in exactly 44 minutes, and Marseilles two hours 23 minutes after taking off, both of which were unofficial records for many years. During this flight, he flew over both the Mediterranean and Scotland.

Before dawn on February 5th, 1939, he took off from Gravesend on what must be, for sheer pluck and human endurance, the most amazing feat in the history of long-distance record breaking. All alone, day and night, in the cramped cockpit of this tiny, overloaded aircraft, he flew to Cape Town and back in four days, ten hours, 16 minutes, thereby setting up records for the journey out, the journey back and the round trip. All three still stand today as solo records and only the first has since been broken by a twin-engined two-seater Service aircraft.

His stops for refuelling, both outwards and on the way back, were at Oran, Gao, Libreville and Mossamedes, all of which, in 1939, had small and undeveloped aerodromes. How he managed to land the Mew at these places, by night as well as by day, without proper facilities, was a source of wonder to all.

The Mew was buffeted by tropical storms throughout its flight over Central Africa, and several times Henshaw was on the point of baling out. In addition to suffering greatly from fatigue, he was attacked on the way home by malaria which he had first caught the previous year during his survey flight in a Vega Gull with his father. His head was cut open by being constantly knocked against the cockpit roof, and to make matters worse, his nose bled profusely. He was, indeed, in a very bad state when he arrived back at Gravesend, and was so overcome by exhaustion and loss of blood that he had to be lifted bodily from the cockpit. For this flight he was awarded the 1939 Britannia Trophy.

The only race in which Henshaw flew the Mew in its long-range form was the 1939 Hatfield-Isle of Man Race in which he took second place at a speed of 217 m.p.h. After that, sterner things than air racing were on the way; M. Victor Vermorel of Lyon bought the Mew, and Henshaw himself became a Spitfire test pilot. Throughout the war the Mew was stored in a hangar on the little airfield at Villfranche-sur-Saone, just north of Lyon. When the whole of France was occupied, Vermorel removed the fuel feed pumps but, although the Germans were apparently aware of the Mew's presence, fortunately they did nothing more than confiscate the journey log book. Despite every effort to recover this very interesting document, it remains on the Continent.

Vermorel was killed in 1945, and the Mew was taken over by M. Jean Drapier. After the war it was moved by road to Lyon-Bron airfield where it was hangared until July of last year when, after an on-site overhaul by Mr. D. E. Bianchi and Mr. E. Squires of Personal Plane Services, it was flown back direct to Blackbushe. Its last previous flight had been in August, 1939. It was still in excellent condition but it had, of course, to be completely stripped down for the renewal of its C. of A. This work has been finished, and the Mew is now flying from White Waltham.

It may be of interest here to account briefly for the absence of the other four Mew Gulls. G-ACND, the prototype, was destroyed in 1935; G-AEKL, in which Mr. Charles E. Gardner won the King's Cup in 1937, and which later was owned and raced by Sir Giles Guthrie, Bart., was completely wrecked in an air raid on Lympne in 1940; ZS-AHO, in which Captain (now Colonel) S. S. Halse forced landed in Africa during the Schlesinger Race, is still lying in a very battered condition near Johannesburg; and G-AFAA, Captain Percival's own was, sad to relate, set alight by firemen during a fire-fighting display shortly after the war. This last-named aircraft was the P6A with rather less than 23ft wingspan. G-AEXF alone remains flying to keep alive nostalgic memories of the time when the British aircraft industry produced such fine racing aircraft as the T.K.4, the Hobby, the Comets and, perhaps the greatest of them all, the Mew Gulls.

In pre-war King's Cup trim, and re-registered G-AEXF, the Mew bears the racing number 22. A Gipsy Six R, with D.H. v.p. airscrew was fitted.

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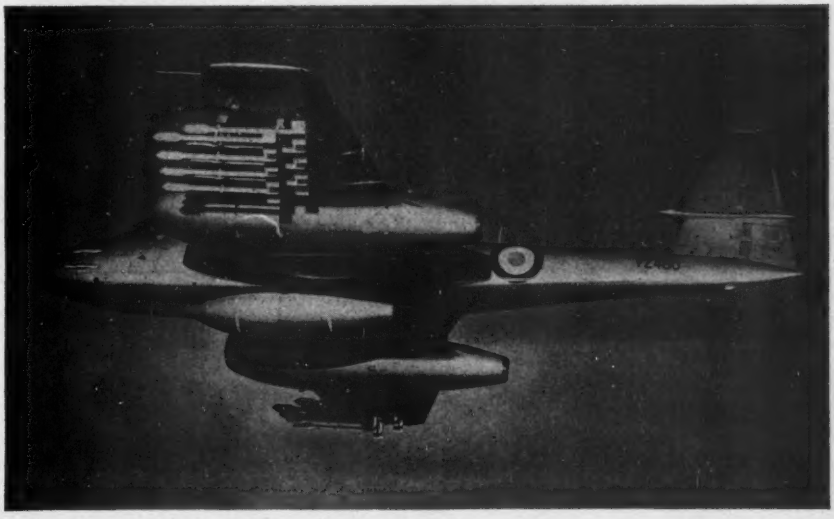

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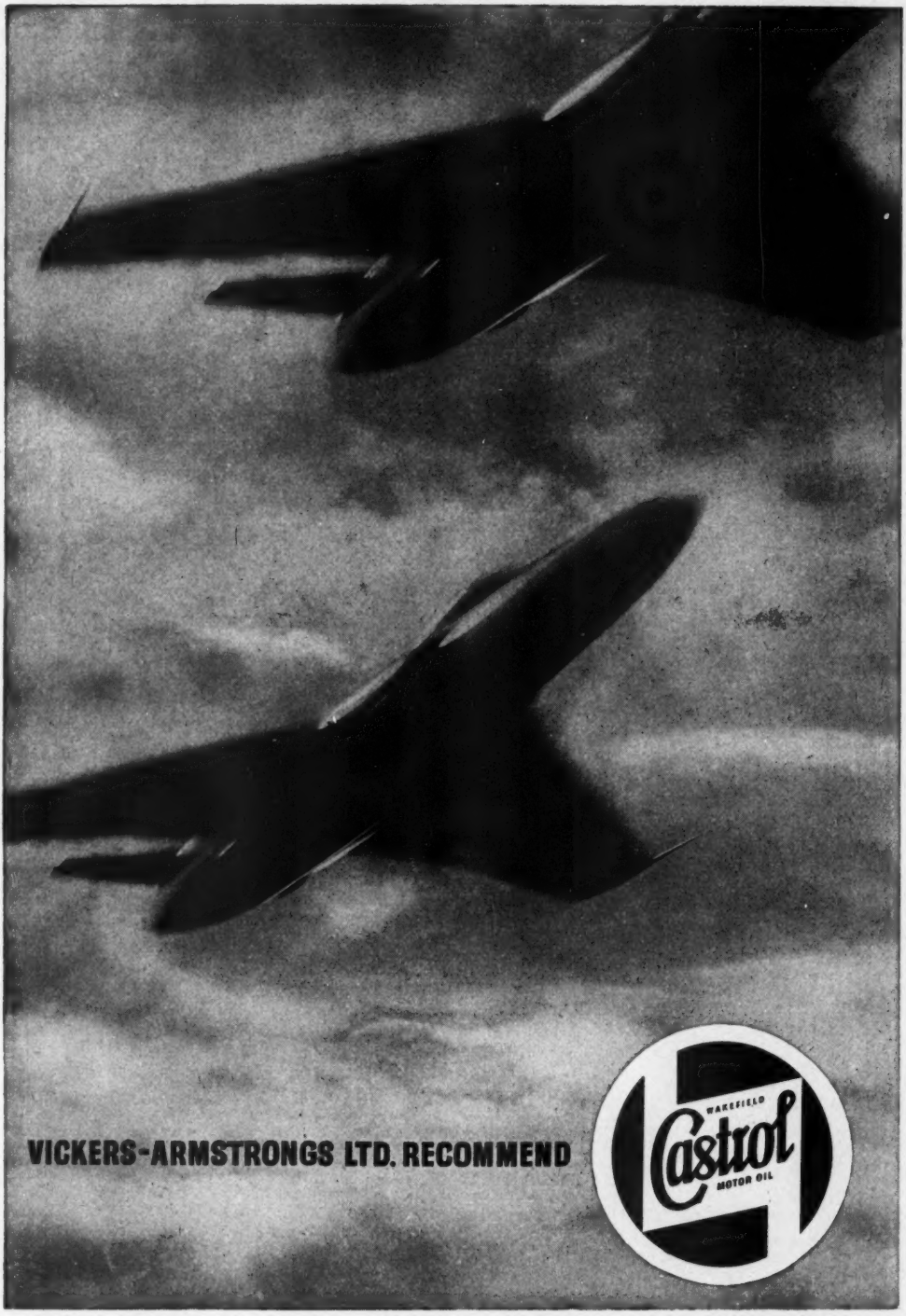
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LIFE OF A THOROUGHBRED . . .

Handling Characteristics

NO two types of aircraft are alike and the Mew Gull can claim to be more than usually different from the remainder by virtue of its specialized nature. In what is essentially a racing and record-breaking mount one must expect to forfeit all forms of luxury, so it is not surprising that the process of clambering from ground to where the seat would be if one were fitted, is a minor gymnastic feat. Once within, sitting on the floor, the pilot forms virtually an integral part of the machine and it is possible to wriggle into some semblance of comfort before juggling with the full Sutton harness provided. The entire hood hinges on the starboard side and clamps in position with two clips of the kind found on most luggage lockers. With the lid closed, a small ventilating panel can be opened if required.

Internal equipage is sensibly presented and comparatively easy to reach. Taking stock of the cockpit from the left, first comes the lever for the manually-operated flaps and this, with its four notches, is fully forward for the "up" position; centrally mounted on the floor is the fuel selector cock with settings for off, auxiliary and main tanks, and on the right under the coaming is the pitch control, which operates in the reverse manner to accepted practice with "fine" at the back stop. This is clearly marked in red but otherwise would, undoubtedly, prove a trap for the unwary. The array of movable knobs and levers, apart from the throttle and mixture controls, which are in their customary places level with the top left longeron, is rounded off with an elevator trim wheel mounted on the extreme right.

Instruments are few but presumably sufficient; the present collection consists of an airspeed indicator, sensitive altimeter, cross level, clock, rev. counter, oil pressure and boost gauges, and a very large compass. Several positions are blanked off, leaving spaces for such useful extras as a directional gyro and a turn and slip indicator.

The Mew Gull was built around the engine and no space was allocated to non-essential ancillaries; consequently there is no starter and it is necessary to swing the metal airscrew by hand, for which operation the throttle should be fully closed and the pitch fine. Warming and running-up follow normal practice, but chocks are needed because the brakes (about which more later) are rather ineffective. Oil pressure settles at the fairly high figure of 50 lb/sq/in and remains there except for a slight "twitch" when pitch is changed.

Taxying in confined spaces is difficult, and it is advisable to have someone at a wingtip until well into the open. In fact, Henshaw formed the habit of walking alongside the aircraft with the hood open and manually heaving to change direction. However, this practice holds no appeal and it has lately been found far more pleasant to sit within and perform a generous amount of nose-weaving from side to side until the take-off point is reached.

Vital actions are of the normal TTMPFFH variety, the only ones peculiar to the Mew being the trim, which should be slightly backward of neutral, and the management of the fuel. No contents gauges are fitted, but as the maximum all-up weight of 1,850 lb allows up to 42 gallons, if the full quantity is on board, there should be no cause for alarm on that score.

A rather tired and tatty machine, but still retaining her pleasing outline, the Mew as flown home from Lyon-Bron airfield in France.

A flight made by the author from White Waltham, earlier in the year, will be described in order to give impressions of the Mew's handling qualities. After aligning into wind, the throttle was opened with abandon, for there is no tendency to swing; as the airscrew clearance is cut within rather fine limits, it is advisable to hold the control column (which is of spade-grip design) neutral, rather than push it forward as is safe on most types. Without any conscious effort from the pilot the aircraft then unsticks at about 85 m.p.h. I.A.S. The grass surface at White Waltham is hardly comparable with a bowling green and this caused some minor bumping and pitching before the Mew came off clean.

Using a strip of 1,200 yd into a wind of about 10 m.p.h. I had reached the recommended climbing speed of 140 I.A.S. on crossing the boundary; as no constant speed unit is fitted, the r.p.m. were on the increase and, at this point, were at the 2,400 mark; I therefore let the machine climb at that speed and setting, giving about 1,500ft per minute. It was necessary to trim almost fully back, due possibly to the quantity of petrol aboard, all of which is contained forward of the cockpit inside the fuselage.

Certain aircraft, by their appearance, give the impression that their low speed and stalling characteristics might be vicious, so with this in mind I took 'EXF straight up to 3,500ft to find how Mews behave in this respect. Throttling back at 150 m.p.h. and holding the nose above the horizon resulted in a long and tedious wait while the speed crawled off the clock almost mile by mile. However, at 100 m.p.h. with flaps up the controls became rather sloppy and at 85 indicated the nose fell away slowly, but firmly, with no inclination to drop a wing. It is interesting to note that 5 m.p.h. or so before the stall an audible warning is given in the form of a whistling of air round the cockpit. It would be quite inexcusable to find oneself accidentally stalling under any conditions.

Normal cruising at 2,100 r.p.m. in coarse pitch results in an indicated speed of about 180 m.p.h., which is considerably lower

For comparison with the photograph on the preceding page, the resurrected Mew, now No. 97, is depicted at Hatfield this year.

Mr. Hugh Scrope, the present owner, who has hopes of matching some of the machine's past achievements in the months to come. Note the very tight-fitting spats.

LIFE OF A THOROUGHBRED . . .

than the pre-war figure. Allowing for position error and other corrections the true figure is probably near enough 200 m.p.h. At this setting the trim needs to be well back and the nose is higher above the horizon than one might expect. I found a tendency to lose height at about 250ft per min while feeling as though flying level.

The controls are quite conventional and very effective throughout the range, with no abnormal stiffening-up effects even during a dive to the airframe limiting-speed of 265 m.p.h. In fact, it is virtually impossible to judge the speed from "feel" alone, except when nearing the stall.

Harmony is not quite as good as it should be, for the elevators and rudder are, perhaps, too lively while the ailerons are rather stiff and very restricted in their travel. The toe brakes feel uncomfortably close to the rudder pedals and it is awkward to keep one's feet away from them.

Unfortunately, the C. of A. is in the normal category so anything in the aerobatic line, strictly speaking, is forbidden. However, it is well known that the Henshaw/Mew combination consistently performed slow-rolls and inverted flying in public, so it is safe to assume that what was possible then can be done now. Steep turns can be made within a small radius, but the "g" effect is very pronounced and considerably more noticeable even than on some faster types.

A few words may be said about the pilot's view. Sideways and downwards it leaves nothing to be desired, but as the cockpit is hardly raised above fuselage level nothing can be seen ahead. The blind spot covers about 30 deg horizontally, when in the normal sitting position, but presumably the original Mew design allowed an average view forward, as it must be remembered that 'EXF still has the lowered hood and top decking.

Returning to the circuit, it is advisable to throttle back and select fine pitch, otherwise the r.p.m. jump rather alarmingly through about 400. The speed soon lowers to about 140 m.p.h. but it is quite a lengthy process reducing to the 110 mark. This is about right for the downwind leg and commencement of the approach, which should be of the curved fighter variety. Flaps can then be lowered as required—although even when fully extended they are not very effective.

Keeping at about 100 m.p.h. all the way in and chopping the throttle about 200 yd from the fence results in a comfortable 95 m.p.h. glide over the boundary, but at this speed the aircraft is almost in the three-point attitude, allowing a very poor view.

Moreover, the float is long and an unhealthy quantity of airfield is used before the Mew touches down at about 75 m.p.h. The over-sensitivity of the elevators presents a problem in itself and the landing consists more of sitting and waiting than a definite check. There is a strong tendency to balloon if a normal hold-off is attempted, but even so, the Mew continues to sink gently and settles down quite happily when ready. Under into-wind conditions the machine continues to run quite straight, but the brakes are not very helpful in bringing it to a standstill.

From the long float mentioned it might be assumed that a slower approach could well be made, but at 90 m.p.h. controls become sloppy even with power on, so it is far more comfortable to have the extra speed and use a fair amount of airfield, so long as there is plenty of it to waste. My landing run at White Waltham towards the railway necessitated a long session of taxying to reach the clubhouse and by the time I had been half-way round the perimeter, I was quite accustomed to the poor view and inefficient brakes. It only required patience and more than usual care.

Stepping out I was slightly deaf as the noise level is consistently high. However, the slight discomforts are negligible when weighed against the Mew's excellent characteristics and performance.

Perhaps the most amazing point about the machine is its extreme docility for an aircraft of its layout, for where one would expect swings and flicks in abundance with the slightest "hamminess" of handling, the Mew Gull forgives all and behaves like any other aircraft; in fact, considerably better than some. On reflection, one cannot help but feel admiration for the designer of such a mount, with its outstanding performance on comparatively low power, combined with quite normal handling characteristics. The only really unsatisfactory feature of this Mew is the lack of forward view for racing—when it is distinctly comforting to be able to see the slower machines ahead. However, that difficulty must have been overcome by Alex Henshaw in the 1938 events and it is no worse now than it was then, so one can only hope that the famous G-AEXF will be able to re-establish its pre-war name.

DISCUSSING IGNITION

SUCH was the response to the International Ignition Conference organized last year by Lodge Plugs, Ltd., that the company decided to hold another meeting on similar lines this year—on July 17/18th at the Savoy Hotel, London. Indicative of the value placed upon the conference by civil and military users of ignition systems is the fact that over one hundred representatives of the world's leading airlines and Air Forces attended. A/Cdre. F. R. Banks, C.B., O.B.E., was in the chair.

As on the previous occasion, the primary object of the meeting was to bring about an exchange of views and experiences on a wide range of problems concerning ignition generally. During this session seven papers were read by acknowledged experts in various fields.

The first day was devoted to the delivery of papers concerning such subjects as "possible solutions to the lead fouling problem," "the merits of ignition analyzers," "recent developments in sparking-plug design" and "the servicing of aircraft plugs." After the reading of the first paper, there was a general discussion on the operating procedures which have been developed by airlines to minimize plug-fouling; suggestions were made concerning the use of extra priming before take-off or during cruise. The use of lead inhibitors in aircraft fuels was also discussed, but it was generally agreed that operators could not yet afford to pay the increased price which the use of suitable additives would necessitate.

The conference was agreed in principle on the desirability of using ignition analyzers, but some doubt was voiced by several representatives as to whether the obvious limitations of the analyzer (such as its inability to detect such faults as cracked insulators or water in sockets) really made it worthwhile.

Following the paper on sparking-plug design and servicing methods, the delegates entered into a very full discussion on the problem of electrode erosion, including the relative merits of massive and fine-wire electrodes. In this connection, it was agreed that the solid electrodes were quite as satisfactory as the fine-wire type when running on lean mixtures, although the latter was said to be definitely preferable for cold starting. Another point which raised a good deal of controversy was the apparent discrepancy between the scheduled "plug-pulling" times of individual operators using a specified type of plug in identical engines. Whereas B.E.A., for example, schedule only 100 hr before removal, Airwork are able to achieve 300 hr of running before the plug is removed. There is also a considerable difference between the running-times achieved by T.C.A. and B.O.A.C. on operations of a similar nature. The delegates considered that this anomaly could probably be accounted for by differences in the engine-operating techniques used by flying crews. It was agreed that there were no grounds to believe that some users adopted lower standards than others.

Under the heading of plug-servicing methods, there was some discussion on developments in the use of solvents as opposed to the sand-blasting technique. It was thought generally that insufficient progress had thus far been made in producing a really efficient chemical cleaning agent. Some interesting information on this topic, incidentally, was made available by Mr. T. R. W. Fennell of the R.A.E., Farnborough, where a considerable amount of success had been achieved by cleaning plugs for a period of one hour with ammonium acetate (with tepol added) in a revolving drum at temperatures of about 80 deg centigrade.

The second day of the session was devoted to a review of aircraft magnetos and ignition harnesses, papers being submitted by B.I.C. Ltd., Rotax Ltd., and Bendix International. The relative merits of high and low tension ignition systems in piston engines were also discussed. Indicative of the modern trend of progress, the closing part of the conference was concerned with gas-turbine igniter systems. Contributions—in the form of papers by Rotax and de Havilland—reviewed the progress which has been made in re-lighting at high altitude, and also dealt with forms of ignition for gas-turbines used in civil airliners.

We hope to publish a more detailed review of the proceedings of the conference in a forthcoming issue.

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This view from the pier looking toward the airport shows the krypton flash lights and the blaze (square) lights in operation.

A New High-Intensity System Installed at Idlewild International Airport, New York

ALL-WEATHER APPROACH LIGHTING

A HIGH-INTENSITY approach lighting system which greatly improves the speed and safety of bad weather approaches has been developed for the Idlewild International Airport, New York. It is installed on runway "C" and is called the "All-Weather Approach Light System."

A pier has been extended three thousand feet into the bay from the south-west end of the runway (the airfield is constructed mainly upon re-claimed land), and on it two alternative sets of lights have been installed, totalling 72 "blaze" and "flash" units. The blaze installation consists of 36 stroboscopic beacon tubes which may be operated in either one of two ways, depending upon the severity of the weather conditions. They can be steady burning at one hundred, one thousand or ten thousand candle power or, if more intense light is needed, they can be pulsed, and in this way develop from 100 thousand to 10 million candle power each.

If this tremendous light source is still not enough to pierce the overcast, the remaining set of 36 light units extending along the pier is switched on. These are the flash units, each consisting of a krypton condenser discharge light with controllable output from one million to five billion candle power. These lights are energized in rotation at the rate of 40 flashes per minute. In actual operation a wave of light is generated which, beginning at the far end of the pier, travels like a bolt of lightning towards the end of the runway, repeating 40 times a minute. Each unit is capable of developing in a twelfth of a second five billion candle power. Yet this system will cost, it is said, only three shillings and ninepence per hour and the life of a tube is 100 hours.

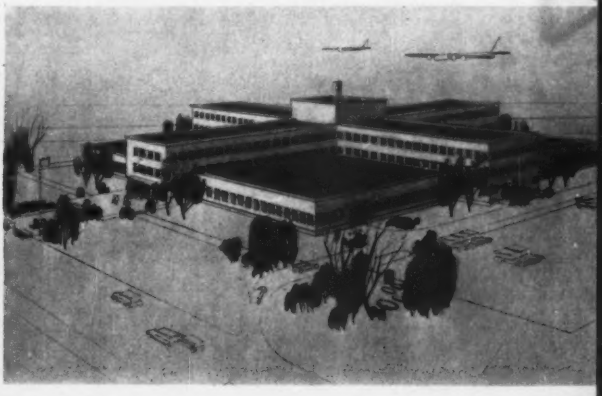
With this system of lighting in operation a pilot, despite heavy fog conditions, can tell exactly at what point he can put his wheels down for a safe landing, even though the runway itself is not visible. Except for a similar Westinghouse experimental installation in Cleveland, this is the only installation of its kind in the United States.

In addition to high-intensity approach and threshold lighting, the Westinghouse system also incorporates a runway designator; this consists of an assembly of luminous tube elements which form either a green arrow ("runway clear") or a flashing red cross (to close all runways except that in use).

The Port of New York Authority has also installed at Idlewild direction signs at the many runway and taxi track intersections.

The new approach-lighting pier, although it cannot be seen in this composite aerial photograph and drawing of Idlewild Airport, extends from the end of the runway at left centre.

This architect's drawing shows the first permanent building to be erected at Idlewild. It will house the regional offices of the Civil Aeronautics Administration and the U.S. Weather Bureau.



EVOLUTION OF THE GUIDED MISSILE

By KENNETH W. GATLAND

Part VI.: The Interplanetary Project

IN the first part of this article, in our issue of May 4th, the author discussed general aspects of his subject and reviewed certain rocket-propelled ground-to-air missiles; Part II (May 18th) went on to discuss air-to-air missiles and rocket-driven intercepters. The third instalment (June 29th) reviewed the development programme carried out by the Germans with the A-4 ("V.2") rocket and its projected derivatives. In Parts IV and V Mr. Gatland dealt with the use of rockets as instrument carriers for high-altitude research. The final instalment herewith discusses the interplanetary project and, more particularly orbital technique.

WITHIN the last decade, mainly as the result of pioneer development in Germany, the rocket has been lifted from the realm of speculation into the world of practical engineering. The Americans, swift to recognize its value as an instrument of scientific research as well as a powerful weapon, are developing the rocket for all manner of important uses and in their hands the science of space-flight, or astronautics, is being shaped.*

The prospect of interplanetary flight, if only in terms of the pilotless missile, has been improved considerably by the RAND Project sponsoring the Earth Satellite Vehicle programme, and the Sunday press has missed no opportunity for projecting its favourite adjectives into the customary mixture of half-truth and fantasy in dealing with the subject. It is often the case that newspaper articles give the impression that the flight to the moon—the initial objective, since it is our closest neighbour in space—will be something of an awe-shattering, "do-or-die," enterprise; but in fact the venture will be the climax of a long series of carefully planned experiments. These can be said to have already begun with our attempts to send instrument-carrying rockets into the upper atmosphere.

The experience accumulated with rockets making farther exploratory journeys away from the earth will later enable us to design and build the first man-carrying rockets. Such vehicles, however, will be nothing like the glamourised "space-ships" of fiction but, in the first place, will be used simply to test human reactions to rocket flight close to the Earth, and they will probably be equipped with wings which enable them to glide back through the atmosphere and land in much the same way as conventional high-speed aircraft. And, certainly, not until a high standard of reliability is achieved in all the various techniques of space-flight will anything so spectacular as a moon-voyage be attempted by a human crew.

It is, in fact, likely that the approach to the Earth's satellite will be made in six distinct stages, approximately in the following sequence: (a) a pilotless missile to orbit the Earth; (b) a pilotless missile to strike the Moon's surface; (c) a pilotless missile to orbit the Moon; (d) a man-carrying rocket to orbit the Earth and descend to the surface; (e) a man-carrying rocket to orbit the Moon and return, and (f) the actual Earth-Moon-Earth flight with a lunar landing. The first of these stages may be reached within ten years—the last may be fifty or even one hundred years away.

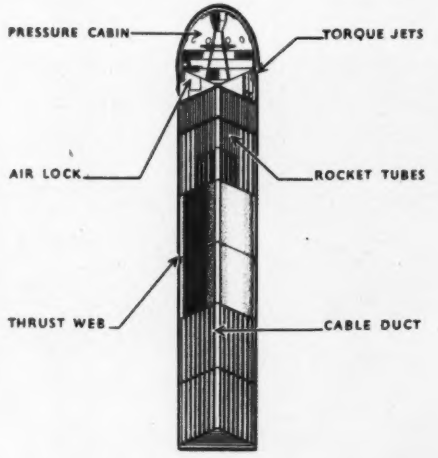
It was undoubtedly Oberth who laid the theoretical basis for the space-ship in his classical work, *Die Rakete zu den Planetenraumen*, published in 1923, whilst credit for the first engineering analysis is due to the pre-war Technical Committee of the British Interplanetary Society.† A study of the literature to recent date will show that the initial objectives of interplanetary flight have always been considered in terms of direct point-to-point missions, such as one finds in the film, *Destination Moon*.

The "Cellular Rocket" (Fig. 29), as the B.I.S. conception was called, focused attention upon the major design problems that would have to be faced, suggesting many solutions (notably in the design of the cabin and instrumentation) which are still considered valuable; and if our modern propulsion techniques do not support the optimism expressed in 1938 for the solid-propellant motor, the design at least corrected the widespread belief that space-ships must be magnificent streamlined creations with fins and rows of portholes. Although now purely of historic interest, the "cellular" propulsion unit comprised approximately 2,000 solid-propellant motors, each quite self-contained, arranged in a kind of honeycomb. The cabin was situated in the nose and the clusters of rocket units were built up layer by layer beneath it, so that the spent cartridges in the first layer dropped off and the next layer fired, and so on, until the vehicle reached escape velocity. Similarly, more layers of rockets were assumed to be used in braking against the Moon's gravitational pull and for the return flight.

In the previous article, it was shown that by employing step construction, guided missiles could be built to achieve escape velocity with propellants already available. That this can only apply to step rockets designed for small payloads, however, is evident from fundamental chemical considerations, which suggest that exhaust velocities of 4 to 4.5 km/sec, will set the practical limit for rockets employing bi-propellants. It is a sobering thought that even when such theoretically promising propellants as oxygen-hydrogen, fluorine-hydrazine, and fluorine-hydrogen, have undergone full development, they will still not be adequate for any two way interplanetary flight if launching is made direct from Earth.

Interest in recent years has, therefore, centred in methods for overcoming these limitations, by refinements in motor design and structural technique, and attempts to improve the theory of space-flight to effect useful economies. Investigation has also been made

Fig. 29. The "cellular rocket" proposed by the British Interplanetary Society in 1938.



* *See the* "First Annual Report to Congress on the National Military Establishment," *December*, 1948.

† *See* "Lunar Space-Vessel," *by R. A. Smith*, "Flight," *February* 12, 1942.

of the possibility of harnessing nuclear energy for propulsion.

A study undertaken by Messrs. A. M. Kunesch, A. E. Dixon and the writer, in conjunction with Dr. L. R. Shepherd, the nuclear physicist, produced in 1949 the first engineering conception of a nuclear-powered rocket (Fig. 30). Principally, we sought to show the influence of a hypothetical reactor with an assumed exhaust velocity, V_e, of 10 km/sec,* on a rocket vehicle capable of circumnavigating the Moon and returning. The reactor was assumed to be of the thermodynamic type† (the most obvious type in terms of present engineering experience, but clearly the most crude form of "atomic power plant"), comprising a graphite-fissile material sectioned up in a kind of honeycomb to provide a large surface area actually inside the combustion chamber. Through it would be pumped at high pressure a working fluid, such as hydrogen or ammonia carried in liquid form, which expands into the propelling jet. Although such a unit still involves a rocket composed of 70 to 80 per cent (by weight) of chemical fluid, it holds promise of an exhaust velocity two or three times that attainable by the best conventional bi-propellant rocket system one can visualise. The survey produced these major conclusions: (a) that given even the optimistic figure of 10 km/sec, V_e, one could not guarantee the fulfillment of the mission. The characteristic velocity‡ of the project was 20.45 km/sec, against 25 km/sec, estimated for a successful round flight with a safely retarded Earth landing. (b) Maximum ingenuity in the structural conception (such as step technique and expendable construction) is essential if an initial take-off mass of 1,000 tons is not to be substantially exceeded and the thrust requirements of the rocket motors much increased in consequence. (c) To reduce radioactive contamination of the launching site and lower atmosphere, and especially to prevent serious blowback effects of the fission products beyond the radiation shadow, a first step chemically-powered booster is required. (d) The atomic-powered section is best suited for operation as a second step, with the crew contained in the head of a smaller chemically-powered third step. The propellant in the latter has the useful advantage of shielding the occupants of the vehicle from all harmful radiations emitted by the reactor. The second step, containing the reactor, would be designed to separate at orbital velocity so that it remained permanently orbiting the Earth, whilst the final step completed the mission.

The survey was a useful pointer to the practical requirements of space-ship design, but the limitations of the various power units (even at the optimistic values of 4 km/sec, for the first and third chemically-powered steps and 10 km/sec, for the atomic step) forced upon us structural problems that can only be resolved at the cost of great complexity and a layout which, although solving the major problem of shielding, is really far from satisfactory.

It is as the result of these and other investigations that attention is now focused upon the orbital rocket, not merely because it represents the first positive stage in astronautical development, but for the solution it offers in orbital technique, the original suggestion of Mr. H. E. Ross and the present writer in 1948.§

It was seen in the previous article that it is much easier for a rocket to enter a closed, stable orbit round a planet than to escape from it entirely, the relative velocities being 7.5 km/sec, for a circumterrestrial close-orbit and 11.2 km/sec, for the "escape" mission. Once step-vehicles can be built capable of reaching orbital velocity with small payloads, it will be possible to develop larger vehicles for carrying propellant and to guide them into the same orbit. The propellant thus assembled, being stored at a high fraction of escape velocity, will represent a substantial energy potential and its transfer into a single "escape rocket" will mean that this vehicle supports itself only from the time it leaves the terminal orbit.

Orbital technique is today regarded as vital in the development of astronautics and has been made the theme of the Second International Congress of Astronautics to be held in London from September 3rd to 8th, when delegates from many nations, including the United States, Germany, France and Great Britain, will be presenting papers on this special subject. Foremost among the papers will be a contribution by Professor Dr. Wernher von Braun (formerly Technical Director at Peenemuende, Germany's great rocket development centre) who is now working on a Government project in the United States. The Congress is expected to inaugurate the proposed International Astronautical Federation (I.A.F.), which aims at promoting the development of space-flight on a world basis.

When anyone suggests refuelling rockets in space and moving members of the crew from one rocket to another, this appears to stretch the imagination of the layman to the "elastic limit." Most of the scepticism arises from ignorance of the principle of satellites and many people have the idea that one rocket will be engaging in a long and hazardous chase of another in order to make the vital connection, Meteor-Lincoln fashion. In effect, once space-flight is established, the actual link-up of two rockets will be achieved with certainly no greater difficulty than the smooth operation already demonstrated by Flight Refuelling, Ltd., in the atmosphere.

What one has to bear in mind, first of all, is that there is no "chase" in the ordinary sense and absolutely no question of buffeting—the objective will be to place the out-going rocket in a matching orbit with the vehicle already circling the Earth. The most economical approach trajectory will be as follows: Take-off verticle, gradually easing from vertical into the curve of synergy, which brings the vehicle into an introductory, or preliminary, orbit at a certain optimum altitude below the desired orbital height. At that altitude, the vehicle will remain itself temporarily in the state of free gravitation without further expenditure of energy. This period will serve for adjustment of the orbit to ensure, in the case of a rendezvous between two orbital vehicles (the first already in the orbital position) proper co-ordination with the "satellite," which the ascending vehicle is approaching because of its shorter period of revolution. Thrust is then applied for a brief interval to accelerate the vehicle from the lower orbital velocity to the velocity corresponding to the perigee of the transfer orbit (i.e. the ellipse whose lowest point is situated on the introductory orbit and whose peak—apogee—is situated on the final "upper" orbit). The vehicle completes approximately half a revolution of the earth, during which time fine adjustment will be given to its velocity so that it will arrive in the required direction at the correct orbital height. To complete the operation, it will then be necessary to accelerate the vehicle from the velocity possessed at the time of reaching the peak of the transitory ellipse to the final orbital velocity.

The successful application of this technique naturally presupposes the development of quite intricate guidance and control equipment but even this does not show up too badly when the problem is considered against its true background. It must be remembered that orbital, or satellite, rockets will exist in a condition of free gravitation and that so long as the location system is sufficiently accurate for two vehicles to be placed into a matching orbit, and homed to a region of proximity, their relative speeds can be brought to zero. An observer looking out from one vehicle to the other would have no apparent sensation that the two were in motion at all, and only the rotation of the Earth and, of course, the slowly changing aspect of the heavens would subsequently be noticed. Actual linkage might then be achieved with no more elaborate equipment than a small line-carrying rocket shot from one vehicle to the other, perhaps homing automatically into some form of "target cage." That achieved, not only could propellant transfer be made and space-suited crew members exchanged, but two components of a composite rocket might fairly easily be

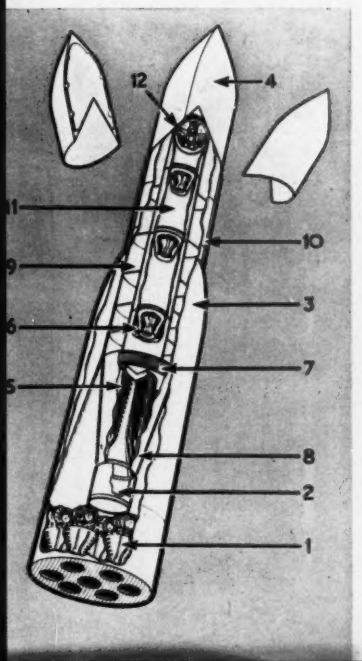


Fig. 30. The atomic-powered rocket—an initial conception (1949). Key to principal features: (1) Chemical booster—seven motors of 450 tons thrust, using liquid oxygen/liquid hydrogen. V_e assumed = 4 km/sec.; (2) Fuel for booster pumps; (3) Expendable tanks for chemical booster (annular type); (4) Expendable tanks for chemical booster (cylindrical type); (5) Atomic reactor: 1,100 tons thrust, using ammonia propellant. Weight, 40 tons. V_e assumed = 10 km/sec.; (6) Turbo-pump feed to reactor; (7) Energy shielding—weight, 20 tons; density, 1 ton per metre³; (8) Gyro-regulated steering jets, incorporating steam exhaust from turbo-pumps; (9) Expendable tanks for atomic propulsor (annular type); (10) Jointed main longerons; (11) Three-step chemical crew rocket, using liquid oxygen/liquid hydrogen. Weight, 60 tons, all-up. V_e assumed = 4 km/sec. (Serving also as health shielding during operation of atomic reactor—density, 6.25 tons per metre³.); (12) Pressurized crew chamber. Weight, 1.4 tons, including crew, instrumentation, provisions, etc.

* *By contrast, today's Viking rocket gives less than 3 km/sec, V_e.*

† *For a detailed analysis of the various possible nuclear propulsion units, see* "The Atomic Rocket," *by Dr. L. R. Shepherd and A. V. Cleaver, B.I.S. Journal, Sept., Nov., '48; Jan., March, '49.*

‡ Characteristic velocity: *the velocity that a rocket-propelled vehicle would attain in space if all its propellants were continuously exhausted from ignition to "all-burnt."*

§ *See* "Obital Bases" *by H. E. Ross (B.I.S. Journal, Jan., 1949), and* "Rockets In Circular Orbits," *by K. W. Gatland (B.I.S. Journal, March, 1949); these papers were submitted independently to the editorial committee of the B.I.S. in October, 1948.*

EVOLUTION OF THE GUIDED MISSILE . . .

joined. If necessary (assuming, of course, that zero "g" has no adverse physiological effect), it would be possible for the crew to work outside the vehicles and to move themselves around the region of the space-ships with the aid of miniature, hand-operated rocket units. In this condition where material is "weightless," considerable feats of engineering assembly could be achieved by one or two men working for quite short periods. The unique properties of the sub-orbit are not widely appreciated and although their consideration, at first sight, may appear to savour of imaginative fiction, they are nevertheless based on well-established principles. The essential point to grasp is that rockets, materials and men, having become "satellites" of the Earth, are held in balance between the inward pull of gravity and centrifugal force; the conditions of "fall," therefore, no longer exist and although all are travelling with an orbital speed of more than 18,000 m.p.h., in terms of one another they are motionless.

With orbital technique, there are four basic types of rocket, each being designed specifically for one role of operation which is complementary to the other three. (Fig. 31). The Types A and B operate together as a composite vehicle; the former acts as the propulsion component for the Type B and remains in the terminal orbit of the destination planet whilst the smaller rocket descends to the surface.

Fabrication of the orbital space-vehicle (Type A) would proceed from the establishment in a circumterrestrial close-orbit of a nucleus-powered rocket, similar in conception to the vehicle of Fig. 30 but omitting expendable tanks, the three-step "chemical" rocket and the crew chamber; these will be replaced by fixed cylindrical tanks. Along the outsides of the vehicle will be carried the light girders and other materials which will later be used in the construction of the landing rocket (Type B) in the terminal orbit.

Once the Type A is established in the sub-orbit, chemically-powered step rockets carrying materials and personnel will climb from the earth and rendezvous in the vicinity of operations. For the most part, these will be guided missiles which are wholly expendable, the final steps (Type C) being designed for use by the construction crew as material for the composite vehicle. For example, the pressurized tank sections of expendable rockets can be used directly as the tubular structure connecting the "atom rocket" to the Type B vehicle. The remainder will be winged rockets (Type D) capable of being refuelled from expendable "tanker" rockets and returning to earth with members of the construction crew.

The design of the landing rocket (Type B) would be determined by the gravitational field strength of the destination planet, and whether it was winged or not would depend on the presence of an atmosphere having a sufficient density to justify the use of aerodynamic braking. If there is negligible atmosphere—as in the case of the Moon—the rocket will descend vertically, using reverse rocket braking in conjunction with a radio-altimeter and landing legs. Changes in course and trim will be made by rocket units situated around the hull, and stability during the final approach to landing would be maintained by gyro-controlled vanes impinging in the exhaust; these vanes will keep the vehicle falling vertically whilst its downward-firing jets act as a brake until, at a small distance from the surface, the moon's gravitational pull is counteracted and the landing legs spread out to take the force of impact. A film of a V-2 taking off, run in reverse, would in fact give a fairly accurate representation of the *landing* technique envisaged.

The Type B rocket will, of course, be useless for anything but landing on an airless body and, as a result, might be left orbiting the Moon while the crew return in the Type A to the original terminal orbit about the Earth; there, winged "ferry" rockets of Type D, using both rocket and aerodynamic braking, would enable them to return to the surface. A later expedition to the Moon might then use the landing rocket after refuelling it from a reserve of propellant carried out for that purpose.

Whereas all the previous investigators have considered the space-ship as expendable, orbital technique will permit the major vehicles engaged in the project to be used repeatedly. It would be rash, however, to suggest that the scheme is the panacea for all our troubles, which is evident in the fact that to place a mere 350 lb of useful pay-load in a close-orbit with available propellants, will require a vehicle of almost 80 tons initial mass.* When we consider bringing not *pounds* of *instruments* but *tons* of *propellant* into the sub-orbit, the problems which still confront us in the interplanetary project are thrown into bold relief. For the refuelling rocket, one would probably aim at a two- or three-step vehicle of 200 to 300 tons initial mass for a payload of 2 tons.

With these figures in mind, we see that the initial interplanetary venture would be made with greater overall effort, greater technical complexity, and the expenditure of more propellant than if the project could be sponsored as a "one-shot" step rocket. But because a direct flight to our nearest planetary neighbour cannot

*See "Conception of an Instrument-Carrying Orbital Rocket," by *A. M. Kunesch*, *B.I.S. Journal*, *May*, 1951.

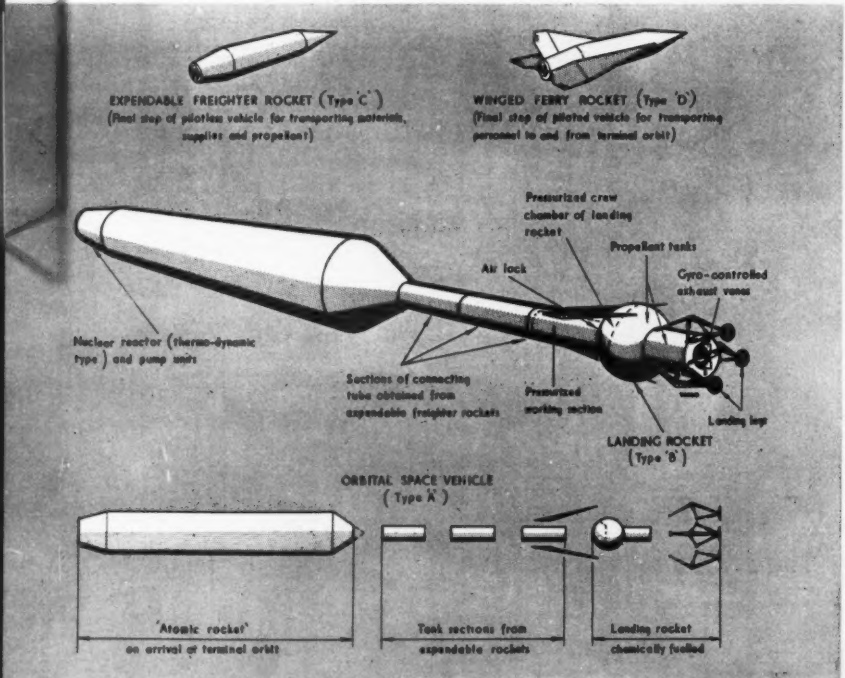

EXPENDABLE FREIGHTER ROCKET (Type 'C')
(Final step of pilotless vehicle for transporting materials, supplies and propellant)
WINGED FERRY ROCKET (Type 'D')
(Final step of piloted vehicle for transporting personnel to and from terminal orbit)
Pressurized crew chamber of landing rocket
Propellant tanks
Air lock
Gyro-controlled exhaust vanes
Nuclear reactor (thermo-dynamic type) and pump units
Sections of connecting tube obtained from expendable freighter rockets
Pressurized working section
Landing legs
LANDING ROCKET (Type 'B')
ORBITAL SPACE VEHICLE (Type 'A')
'Atomic rocket' on arrival at terminal orbit
Tank sections from expendable rockets
Landing rocket chemically fuelled

Fig. 31. Illustrating orbital technique. Instead of landing the entire spaceship, a secondary rocket will descend to the surface whilst the major vehicle (which contains the flight propulsion motors and "return propellant") remains in a sub-orbit of the destination planet. The project is begun in a circumterrestrial orbit 500 miles from the surface and involves rockets of four types:—

Type A: Initially a ground-launched nuclear-powered rocket which is adapted in the terminal orbit to suit its specialized role as the orbital space-vehicle. Type B: The secondary landing rocket, built in the terminal orbit from prefabricated sections brought out by the Type A vehicle and small expendable rockets of Type C. Type C: Expendable rockets for bringing material and propellant to the terminal orbit. Type D: Winged "ferry" rockets for transporting personnel between the Earth and the terminal orbit. The Types C and D depicted are the final stages of 2- or 3-step rockets with take-off masses of between 200 and 300 tons: to improve the economics of the operation, every attempt would be made to recover the initial steps for re-use, possibly by means of "ribbon" parachutes, with a minimum of thrust braking. Alternatively, they might be fitted with wings which act in the line of flight during ascent but convert the empty steps into gliders after separation.

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One of the Doves in the service of Williamson Diamonds Limited lands at the Company's mine in Tanganyika with two hundredweight of tractor spares, two milk churns, six cases of brandy, 150 lb. of floor polish, a case of car spares, a tool chest, a petrol engine, a windscreen, 70 lb. of stationery, 30 lb. of fresh meat, two suitcases, three hundredweight of steel tyres and ten live ducks

DE HAVILLAND DOVE

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EVOLUTION OF THE GUIDED MISSILE . . .

be made even assuming the existence of an atomic reactor capable of 10 km/sec V_e, orbital techniques are a realistic means of spreading the "energy load" in such a way that, if we are prepared to take the trouble, we could achieve space-flight with an exhaust velocity of half that figure. There are doubtless people who will say that this additional complexity is out of all proportion to the objective—the project's "real-estate value" as the Americans would term it; but there is just one vital point that should not be overlooked. In developing this elaborate "space-shuttle," we shall be building up a practice that will pay increasing dividends with each new venture across space and, in the long-term view, this will be much more beneficial than if we begin with one mighty rocket that just manages to crawl home.

From the engineering point of view, the great advantage of orbital technique is that the separate rockets can be designed exclusively for one special task, and their different conditions of operation suggest great divergencies in appearance and equipment. The Type A, once initially established in its terminal orbit around the Earth, would never land on the surface of any planet and since it would always operate in free space, it would make use of nuclear power.

It might also use the technique of accelerating to the velocity required for its voyage-orbit at a low rate by the continuous application of a relatively low thrust for a fairly long period, as Messrs. L. R. Shepherd and A. V. Cleaver have discussed in their paper, *The Atomic Rocket*. In this case, the structure of the Type A vehicle would never be subjected to high stresses and could, therefore, be of a character appearing extremely light by any terrestrial standards—even those of aircraft construction. Moreover, since the vehicle would never be required to penetrate any atmosphere, no considerations of streamlining whatever need influence its shape.

Finally, there is the case of the secondary rocket Type B. This vehicle has a low fineness ratio, which minimises the risk of toppling on landing, and its small mass in comparison with a rocket making the flight from Earth to Moon in one stage offers valuable economies, since it will not have to carry down to the surface the flight propulsion unit (which, as we have seen, will probably comprise a nuclear reactor and heavy shielding) and the propellant required for the return journey. These points are well illustrated in a comparison of the Type B rocket with the giant space-ship from the film, *Destination Moon* (Fig. 32), which was depicted as fulfilling the complete two-way mission with a thermodynamic nuclear reactor. In fact, it is difficult to see how an atomic-powered rocket could land on the moon because the fission products of the exhaust would contaminate the landing area and dust clouds thrown up by the blast would also become dangerously radioactive.

These are some of the problems and prospects of interplanetary flight. Man's relentless endeavours have resulted in the earth giving up most of its secrets, and it is natural that interest should now range to worlds beyond our own. But the quest for knowledge and the advancement of science, important though these may be in their own right, are not necessarily the primary benefits. The mass concept of the Universe today is no more advanced than it was at the time of Copernicus, and the cardinal benefit of space-flight may well prove to be the extension of the stream of human consciousness that will result once Man and his tiny world are seen in the objective light of the cosmos.

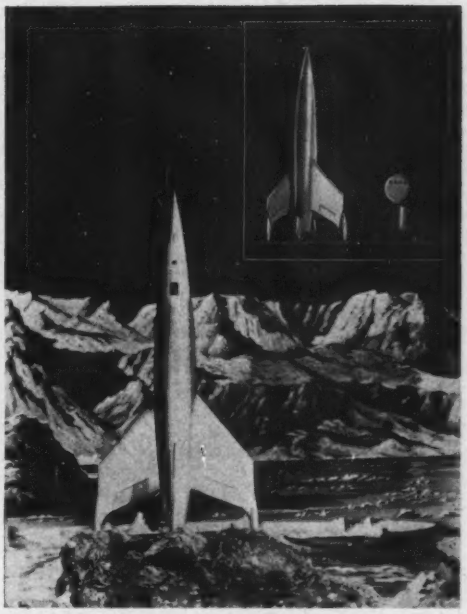


Fig. 32. Standing 150ft high in the crater "Harpalus", the spaceship prepares to depart for earth—a scene from the George Pal Production "Destination Moon." Inset: The spaceship compared with the landing rocket, Type B, suggested by "orbital technique."

SIXTEEN COATS

IT is announced by Cellon, Ltd. (who, as recorded in our issue of April 13th, have completed 40 years in the production of aircraft finishes) that one of Britain's latest high-speed prototypes has been given no fewer than 16 coats of primer and finish, this involving a weight penalty of the order of 30 lb. The company is also developing a finish for guided missiles.

WASTE PAPER—EVERYBODY'S CONCERN

THE effect of paper wastage on the rearmament programme and not least, on the national economy, has assumed serious proportions. The recovery of waste paper is a vital task, for over 1,000,000 tons of it will be required *this year* to meet the demands of the Defence programme, the export drive and the home market. Waste paper is, moreover, worth money to the conserver. Merchants are prepared to buy, and collect, waste from large business organizations, and the sums involved are not small. Names and addresses of waste paper merchants throughout the country may be obtained from the Waste Paper Recovery Association, 52, Mount Street, London, W.1, but those in the main centres of chief interest to the aviation industry are as follows:

Manchester: E. Butterworth and Co., Ltd., O Department, Pollard Street, Manchester; John Caldwell and Sons, Ltd., Sun Mills, Wharf Street, Ancoats, Manchester 4; Chadwick, Lunt and Co., Ltd., Indigo Street Mills, Pendleton, Manchester; John Philbin and Son, Ltd., 17, Newton Street, Manchester 1.

Birmingham: Birmingham Waste Co., Ltd., Moland Mills, Belmont Row, Birmingham; John Bayliff, 6, Sherborne Road, Birmingham; Paper Stock Co., Ltd., Hack Street, Birmingham (also at Coventry); Littlehales and Sons, 26, Cheatham Street, Birmingham; John Steele, 45-46, Heneagle Street, Birmingham; Warwickshire Waste Co., 113, Bradford Street, Birmingham.

Coventry: Frank Havard and Co., Upper Well Street, Coventry.

Bristol: Albion Paper Products, Ltd., 338, Two Mile Hill, Kingswood, Bristol; Stock and Co., Backfield Lane, Bristol 2; E. J. and H. E. Rose, Ltd., 11-13, Lamb Street, Bristol 2.

FORTHCOMING EVENTS

Aug.	4-5.	Aero-Club de Touraine: International Rally, Tours, France.
Aug.	6.	*Daily Express* Challenge Trophy International Air Race. Shoreham Airport, Sussex.
Aug.	11.	Leicestershire Aero Club: Rally and Display, Leicester East Airfield.
Aug.	12-18.	International Air Circuit of Switzerland.
Aug.	18.	Wiltshire Flying Club: Thruxton to Isle of Wight Air Race.
Aug.	18-19.	U.S. National Air Races, Detroit.
Aug.	19.	Yorkshire Aeroplane Club: "At Home" (sponsored by A.B.A.C.).
Aug.	25.	Exeter Aero Club: Display.
Aug.	25-26.	Skegness Airport: Aerial Week-end.
Aug.	25-26.	International Air Circuit of the Dolomites, Italy.
Sept.	1.	R. N. Air Stations Gosport and Lee-on-Solent: Air Display.
Sept.	2.	A.B.A.C. Summer Convention.
Sept.	3-7.	R.Ae.S. and I.Ae.S.: Third Anglo-American Aeronautical Conference, Brighton.
Sept.	3-8.	International Congress of Astronautics.
Sept.	9.	Society of Model Aeronautical Engineers: Model Flying Festival, Sherburn-in-Elmet.
Sept.	10-16.	Battle of Britain Week.
Sept.	11-16.	S.B.A.C.: Flying Display and Exhibition, Farnborough.
Sept.	15-16.	International Rally, Parme, Biarritz, France.
Sept.	25.	Milan International Grand Prix.
Oct.	31.	R.Ae.C.: Jubilee Ball.
Dec.	17.	Institute of the Aeronautical Sciences: Fifteenth Wright Brothers' Lecture, Washington, D.C.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Hurricane Warpaint

SOON after reading the paragraph about the five Portuguese Air Force Hurricanes in to-day's *Flight*, I was delighted to see the said five flying in fairly tight V-formation. They cruised around during the afternoon, at about 800-1000 ft and finally landed at Kenley. All five carried the squadron markings US, which were, I believe, those of No. 600 (City of London) squadron.

If, as you say, the Hurricane, *Last of the Many*, was the original one taking part in the film *Angels One Five*, then it must have done some fairly rapid quick-change acts from "uniform" to "civvies" and back. I saw it on June 11, and I think on one or two days after that, in 1940 warpaint; it was at Hatfield on June 23 in gold and blue finish, registered G-AMAU, and I saw it again with its companion on July 2, back in "earth and spinach" camouflage.

Caterham. IAN H. GORDON.

P.S.—Also at Kenley is a far-from-airworthy Messerschmitt Me 110, with very battle-scarred elevators. Included in the bits and pieces scattered around is a nose section with somewhat primitive airborne radar antennae.

S.E.4 and N.A.C.A. Cowling

IN his most interesting and informative article, "Fifty Years of Flying," Mr. J. W. R. Taylor states the very advanced features in the design of H. P. Folland's S.E.4 Scout included a N.A.C.A.-type engine cowling.

I am a bit puzzled regarding this point, since according to George W. Gray's excellent book *Frontiers of Flight* (the whole fascinating history of N.A.C.A. in a 375-page volume), the beginning of this now huge American organisation was in 1920, when the Langley Memorial Laboratory was opened with just one 5 ft wind tunnel! I will admit I do not know the actual year the revolutionary S.E.4 was built, but since the S.E.5 went into service with the R.F.C. in 1917-18, I presume the former was built before these years?

Again, according to *British Aviation Who's Who*, H. P. Folland was at that time assistant designer at the R.A.E. Farnborough where he was responsible for the F.E.2b and the S.E.5 as well as the machine referred to above.

Perhaps you could kindly clear up this point in regard to the S.E.4?

Prestwick. DENNIS M. POWELL.

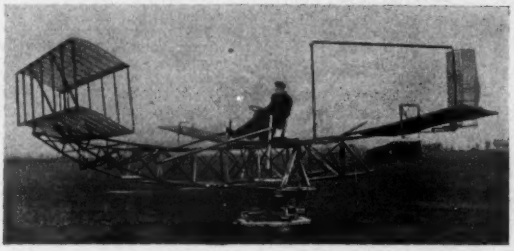
[Mr. Taylor explains: The cowling fitted to the S.E.4 was a "long-chord" type, as developed so successfully *later* by the N.A.C.A. It would not be strictly correct to refer to it as an "N.A.C.A. cowling," but the R.A.E.'s own historians describe it as such in their official history of the "Factory." Although Mr. Folland was only classed "assistant designer" at the time, he was, as stated in my article, responsible for the S.E.4 and the later, better-known, S.E.5.]

Flight Simulators

THE design and construction of flight simulators and synthetic training aids for aircrew figure largely in our normal line of business, and during the past twelve months I have read certain correspondence in *Flight* as to who was the first to introduce such devices as training aids. It therefore caused me no little amusement when, glancing at a copy of *Flight* dated December 10, 1910, I found a description of the Sanders "teacher." This device was certainly a synthetic training aid, and, indeed, might be described adequately as a flight simulator.

London, S.W.18. NORMAN HILL, Redifon, Ltd.

[The original description of the Sanders "teacher," to which our correspondent refers, contains the following passages: "Even the most apt pupil is certain to find himself in difficulties at some time or another during his probation, and owing to lack of skill the machine is necessarily sacrificed to save his life, or at least to prevent a serious accident. The invention, therefore, of a device which will enable the novice to obtain a clear conception of the workings of the controls of an aeroplane, and of the conditions existent in the air, without any risk personally or otherwise, is to be welcomed without a doubt. Several have already been constructed to this end, and the Sanders "teacher" is the latest to enter the field. Now there is a tendency to design such an apparatus . . . without any real resemblance to an actual aeroplane. The Sanders "teacher" seeks to overcome these difficulties. In the first place the "teacher" so closely adheres to the construction of the actual aeroplane that the pupil in learning to control it is simultaneously learning the control of the machine he wishes to pilot. . . . In the second place the balance of the "teacher" is so arranged on scientific principles that the conditions are practically the same as if the pupil were actually in the air. The varying force of the wind has effect in almost an identical manner as on a working aeroplane, while the niceties of lateral and longitudinal stability are not carried to an extreme." There follows a description of the construction, together with a diagram and the photograph reproduced above.—ED.]



The Sanders "Teacher" referred to below.

Airline Glide-Path Angles

I HAPPEN to be one of the occupants of a modern block of offices situated at the east end of the east-west runway at Northolt, and for the past three and a quarter years have been ideally situated to study the different techniques demonstrated by the pilots of various airlines, whilst landing.

It was soon noticed that whereas the Scandinavian and Swiss airlines used to adopt a steep approach for maximum safety, B.E.A. invariably crept in over South Harrow at as low an altitude as possible, flying for the last half mile horizontally and obviously hoping that they would be able to clear the railway embankment, complete with telephone wires.

As far as can be seen, this type of approach is adopted just to (*a*) show off to the passengers, (*b*) scare the living daylights out of the local population, and (*c*) plonk down just over the hedge and stop before the intersection, so as to avoid taxying round the perimeter track.

It is suggested that flying discipline in B.E.A. should be considerably tightened up as, if it is not, a similar accident to the *Edmonton* one in 1938 is visualised, only worse.

I would also like to take this opportunity of enquiring if it is really necessary for B.E.A. to practise one-engine flying over Pinner and one-engine approaches to the aerodrome. There is plenty of open country near Northolt: why pick on a populated area?

In this respect, the final last straw happened on Sunday, July 22, at 10.40 a.m. when a Viking suddenly appeared over Eastcote, doing a left-hand circuit, with the port airscrew feathered at an altitude not exceeding an absolute maximum of 350 ft. It is presumed that in this instance the aircraft was in distress, because the altitude was even too low for B.E.A.'s normal flying, but if it was not, the pilot ought to be grounded and awarded the M.H.D.O.I.F., complete with all joints that had ever been heard of.

The registration number would have been taken if I had not been paralysed with fright.

Pinner. W. B. HOLROYD.

[In good weather the approach to land is to some extent dictated by the design of the aircraft; a Viking has a shallow approach angle. Under instrument conditions, the glide path is determined by the setting of the approach aid in use, and this, in turn, is averaged to suit all the types of aircraft likely to use it.—ED.]

Even with undercarriage extended, cockpit open, and test equipment festooning the fuselage, the P.1067 is a thing of beauty.

HAWKER P.1067

Avon-powered, Swept-wing Intercepter Ordered "Off the Board" for R.A.F.

IT is with a sense of relief that we announce Hawker's newest fighter, the P.1067 single-seater intercepter, powered with a Rolls-Royce Avon turbojet—relief not only because this most impressive aircraft may now be openly discussed (within the bounds of security), but because it belongs to a class of which the R.A.F. stands sorely in need.

Like the Vickers-Supermarine Swift, a fighter of similar character, the 1067 was ordered "off the drawing board" and quantity production was already being planned before the prototype left the experimental shops at Kingston for the Ministry of Supply establishment at Boscombe Down, where the first flights were made by S/L. Neville Duke, D.S.O., D.F.C., A.F.C.

In frontal aspect the P.1067 strongly resembles its progenitor, the P.1081, but the undercarriage is much wider in track.

It is almost unnecessary to add that the design team responsible was led by Mr. Sydney Camm, C.B.E.

As Mr. Neville Spriggs, O.B.E., general manager of Hawker Aircraft, has pointed out, the new fighter brings airframe construction into line with the tremendous advances in turbine power plants which have given Britain a lead over the rest of the world. The photographs herewith show at a glance that the 1067 is a logical development of the P.1040, Sea Hawk, P.1052 and P.1081 series of Hawker jet fighters. The wing plan appears generally similar to the P.1081's, and the wing-root intakes and tail orifice of that type are retained. A novel feature, so far as the Hawker Company is concerned (though already seen on the Boulton Paul P.111 delta and American Lockheed F-90), is the long, straight spine atop the fuselage between the cockpit and fin. No dimensions have been announced, but the fuselage is evidently longer than the P.1081's. There is, however, a marked similarity between the two types in the design of the vertical tail surfaces and in details of the undercarriage, though it will be observed that the attachment points of the main wheel assemblies have been moved relatively further outboard, thereby providing an unusually wide undercarriage track.

The photographs afford no evidence of armament, but it may reasonably be supposed that a machine having the dimensions and power of the P.1067 might accommodate a much heavier offensive load than, say, the Sea Hawk, which mounts the standard British fighter armament of four 20 mm guns.

STRESS ANALYSIS AT HEIGHT

Strain-gauging of Turbine Blades During Flight

IN the July 6th issue of *Flight*, brief mention was made of the salient features of the system developed by Rolls-Royce, Ltd., for measuring and recording the dynamic strains in turbine blades during flight. Further details of the method used have now become available.

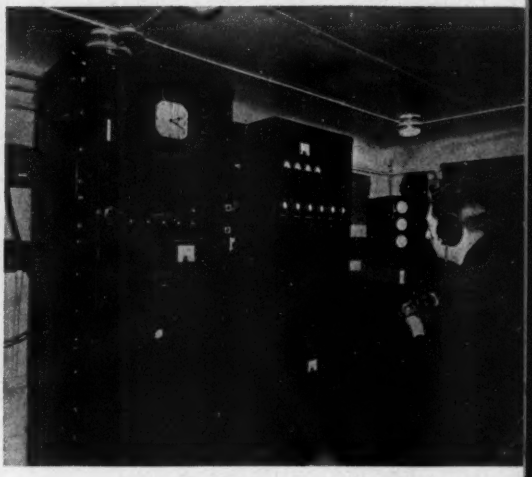
The measurement of blade stresses in a turbine operating at normal running conditions in flight clearly presents considerable difficulties, not the least of which is to get a strain-gauge or other form of indicator to adhere to the turbine blade at temperatures which may exceed 700 deg C, whilst withstanding centrifugal forces which may be equal to 20,000 times the weight of the gauge. However, the troubles are not over even when difficulties of adhesion between gauge and blade have been overcome. Some ceremics create random noise effects at high temperatures which may, in fact, be greater than the voltage representing the stress variations, and, too, the best material for mechanical strength may be entirely unsuitable from an electrical point of view. Another problem is the design of suitable slip-rings to convey the signal from the rotating turbine to the radio transmitter.

Early in 1950, Rolls-Royce overcame these difficulties one by one, until the measurement of turbine blade stresses on Derwent engines running on the test-bed became almost a routine matter. Stress measurement of blades whilst engines were undergoing flight test was the next goal, and the provision of special ground recording equipment enabled this to be achieved by the summer of the same year.

Once equipment had been developed that gave reliable indication of blade stresses in an engine on a test-bed, there was no great difficulty in modifying the standard aircraft radio equipment to transmit the necessary intelligence to the ground; the satisfactory recording of this information does, however, present some difficulty.

One characteristic of turbine blade stresses is that they are resonant and are, therefore, greatest at certain well-defined speeds. This necessitates measurements being taken at the exact peak of the resonances corresponding to the various modes of vibration. It is difficult, but possible, to adjust the engine speeds sufficiently accurately for these stresses to be measured whilst the engine is on a test-bed, but it is quite impossible to do so in the air, as the pilot cannot be expected to adjust his engine speed to within 5 or 10 r.p.m. in 14,000 r.p.m. Even if he could do so, those responsible for the measurements would never feel confident that the speed really had been correctly adjusted. Experience has shown that the best thing to do is to ask the pilot to increase the engine speed gradually, and so make quite sure that at some instant the turbine blades will be vibrating in resonance.

In order to record the strain-gauge signals for a frequency of the order of 11,000 cyc/sec (by photographing the trace of a cathode tube) it would be necessary for the film in the camera to move at about 500in/sec—nearly 30 m.p.h. It would be impracticable to run film through a camera at this speed throughout a gradual acceleration of the engine, which lasts at least ten seconds. If, alternatively, the pilot were asked to accelerate the engine more rapidly, one could never be certain that the blade stresses had risen to their true maximum value while the resonant speed was being passed. This difficulty has been overcome by recording on a magnetic tape the whole of the signal received from the aircraft. For convenience, conversation between the ground and the pilot is also recorded on the tape. Later the tape is played back and the intelligence translated into stresses by photographing the trace of a cathode ray oscilloscope which is connected to the re-play amplifier of the recorder.



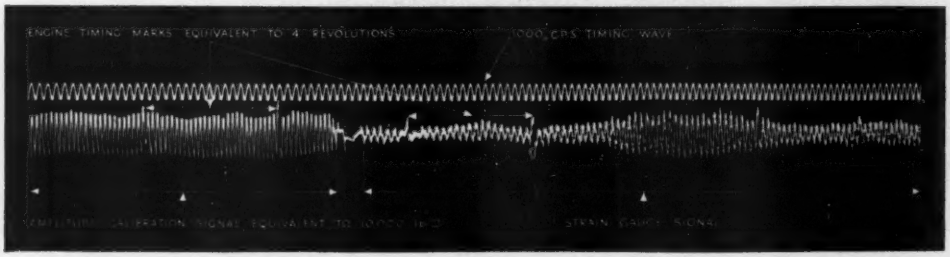
Interior of caravan furnished with equipment developed by Rolls-Royce for the measurement of dynamic strains in gas turbines.

This tape recording may be played back any number of times, and it is, therefore, a relatively simple matter to ensure that the film is moving through the high-speed camera just before any peaks in the resonances of the blades are reached.

An alternative method of analysis which has proved successful and accurate, employs an electronic frequency analyser developed for Rolls-Royce by Muirhead, Ltd., in connection with Parmatrada, Ltd.

The technique of studying turbine blade stresses in flight is in its infancy, and this very special form of measurement has necessitated the development by Rolls-Royce of methods which were previously unknown. The form of telemetry used, so far, is of a comparatively simple nature but is, nevertheless, effective. For future work the company envisage a system similar to that used in various forms of rocket research.

Typical record showing strain-gauge signals from Derwent 5 turbine blades during flight.



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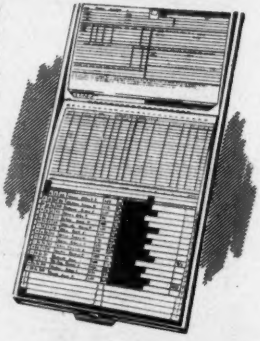

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THE NAVY, and COASTAL COMMAND

A New Plea for Transfer

By ICARUS

IN a recent leading editorial (July 13th), *Flight* drew attention to the increasing potential of Russia's aircraft industry—or such glimpses of it as can be obtained through chinks in the Iron Curtain—and special note was made of the fact that Russia appears to be aiming at a balanced air force. But even less is publicly known of the organization of Soviet air power for waging possible war, and it is upon the correct set-up of any organization that success must, it is contended, primarily depend.

By comparison with the rapid technical advances made in the aeronautical sphere since the Wright brothers first flew, appreciation of the military value of aircraft has sadly trailed in the rear. Certain it is that air power played a dominant role in the last war, but have we fully learnt the lessons? Or are we still lagging behind, improvising, modifying, patching up the structure, when we should be prepared if necessary to re-build from the base up? In the vast and intricate game of war, even a half-trained side who know how to act as a team stand a better chance than a band of well-trained individuals who don't.

Russia's policy must inevitably be influenced by the fact that she comprises a huge land mass. As a scattered Commonwealth, separated by the blue wastes of oceans we, on the other hand, must command those spaces if the other two arms of our fighting organization are to be capable of performing their functions. Have we learnt past lessons aright in this respect?

First, it is essential to get a correct interpretation of the term "air power." Many people believe it to be a distinct third "force" to be exclusively wielded by a separate organization. But the aircraft is not a weapon; it is a platform—a medium for delivering weapons at the objective or from which observations are made. The last war proved, for example, that major battles cannot be fought successfully by armies without close air support. Similarly, in the case of the Navy, the aircraft is not only the means, but the major means, by which sea power is now wielded. The important role Coastal Command plays in the exercise of sea power can thus be seen. True, the Navy has its own carrier-borne aircraft, but these play a specialized role in sea-air warfare; a role, moreover, that has, it is suggested, diminished in importance from the great heights it attained in the brilliant Pacific campaigns of the last war. While the speeds of modern aircraft continually increase, the speeds of ships have remained static for 30 years. Carrier-borne aircraft are, therefore, handicapped by the pace of the ships that carry them, so that their functions are largely becoming circumscribed to "areas of opportunity," i.e., they must wait for the battle to come to them. In global warfare this is not enough; in the time it takes a fleet to weigh and leave harbour, a land-based force of medium-range strike aircraft could be attacking an enemy naval objective 500 miles or more away. That is where Coastal Command comes in—or should do.

But while Coastal Command is controlled by the R.A.F. it suffers from two severe handicaps. To appreciate the extent of the first it is necessary to understand the primary functions of the R.A.F. in relation to modern developments.

The type of fighting in Korea must not be allowed to mislead us; preparations for war between major powers cannot ignore the major weapon—the atom bomb. It has destructive powers so vastly superior to anything hitherto known that the chances of winning a war with the first blows have been immeasurably increased. And, for that reason, an aggressively-minded nation has increased its advantage over a peaceably-minded opponent in direct ratio. The timing and placing of those first blows are, however, all-important; so important, in fact, that any miscalculation will result in retaliatory blows that must give the aggressor considerable pause. That is, if the peaceable country is adequately prepared.

Wing Commander Lucas, M.P., has stated what he considers should be the immediate measures to be taken by the Government to counter the potential threat from the Russian Air Force. Briefly, and in this order of priority, he said that these should be (1) the provision of a strategic, long-range bomber force; (2) concerted planning between the Commonwealth and America on strategic bombing policy; (3) a speed-up in guided missile development; and (4) re-equipment of our fighter squadrons with the latest swept-wing fighters.

It is the vital need for preparations for immediate retaliatory action that lends so much support to those proposals; for speed in counter-attack and defence is essential, and only air power has the requisite speed. The first and fourth measures are the direct concern of the Air Ministry, whose problem is so difficult that it should occupy their attention exclusively if a practical solution is to be found.

For those reasons, Coastal Command can only be regarded as of secondary concern in the minds of the Air Ministry in view of the R.A.F.'s primary functions. (It may even be of tertiary concern, for there is also the tactical air force for army support to be considered.) How best to equip and deploy a defensive screen of fighters to intercept the enemy's strategic attack; how best to equip and deploy our own strategic bombers for delivering the immediate retaliatory counter-attack—these supreme problems can only be solved at the expense of thought on the others. Coastal Command is suffering this inevitable neglect just as she suffered between the wars, to our terrible cost in the first years of the U-boat campaign.

The second handicap is that R.A.F. training does not normally embrace maritime operations, and when officers and men do a tour of duty in Coastal Command they have to learn the ways of sea-air warfare, discarding some concepts and accepting new. But that takes time; and just when they are becoming proficient they are liable to be sent to, say, Bomber Command. This is a costly process; the more so because proficiency is inevitably lost when new tricks have in their turn to be learned elsewhere.

These remarks are not to be read as a reflection on the efficiency of Coastal Command; its record stands too high for denigration. Yet that does not imply that proficiency cannot be improved. The arts of sea-air warfare cannot be mastered in a few years of temporary study and practice; so it should not be necessary to argue that full proficiency can be achieved only if a man's whole Service life is devoted to it, just as the soldier's is to military and the sailor's is to naval affairs—indeed, as the airman's *must* be to those matters connected with the primary functions of the R.A.F. In other words, because Coastal Command plays a major role in the application of sea power, it should, naturally, be a completely naval entity.

How could such a transfer take place without disrupting both the R.A.F. and the Navy for many years to come? The history of the transfer of the Fleet Air Arm to the complete control of the Navy in 1938 is a warning of what to avoid. The Navy must have not only the material, but it must also have the knowledge and technical skill for the discharge of such a responsible task. There is not sufficient experience in Naval Aviation efficiently to assume the different and larger function involved here. The only way that quality can be assured is by transferring *all* Coastal Command personnel with the material. It would, of course, have to be done so that no one suffered, either financially or in rank. On the contrary, it would be necessary for this large force to be represented at all levels of Naval command (which, in some cases, would undoubtedly entail granting higher rank to ensure corresponding equality of status), and not least at the highest level—the Board of Admiralty. No other way could avoid severe dislocation.

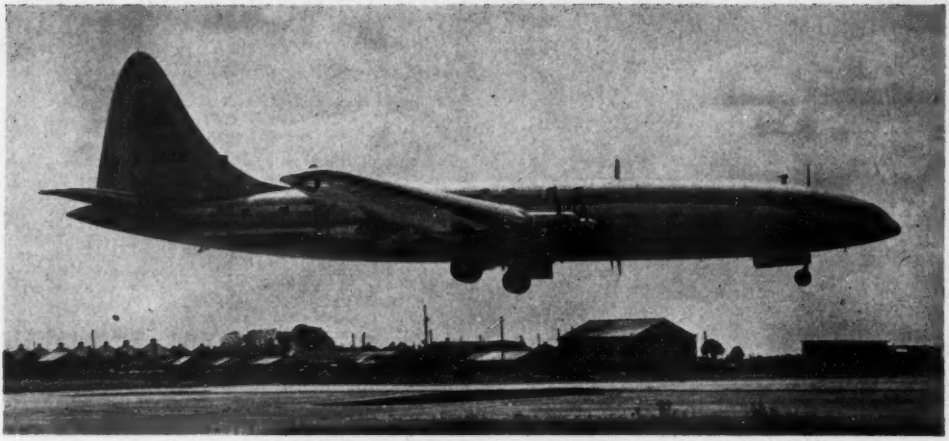
There is no thought here of raising an old controversy in a partisan spirit. In his statement on U.S. Military Policy for 1950, General Omar Bradley, as Chairman of the Joint Chiefs of Staff, has stressed the need for "a *balanced* development of all three forces—balanced against the missions and assignments each is to perform in the defence plan." Without adequate air power the Royal Navy cannot efficiently discharge its "missions and assignments."

The transfer of Coastal Command would not create a precedent—the reverse happened on a larger scale at the end of the first war, when the R.N.A.S. and R.F.C. amalgamated to form the R.A.F.

If the validity of the arguments put forward is admitted—that it is essential, not for Naval prestige, but to enable the exercise of sea power to be fully efficient and effective—then it is, surely, in the national interest that it should be done?

POWER JETS SYLLABUS

POWER Jets (Research and Development), Ltd., announce the following details of the short courses available at the School of Gas Turbine Technology, Farnborough, which is open to students of British and Commonwealth nationality: In 1951, Course 38, Aero-engine Design, Aug. 19th-31st; Course 39, International Course on Aero and Industrial Gas Turbines, Sept. 16th-Oct. 5th; Course 40, Practical Aero Engine Course, Oct. 8th-19th; Course 41, Design and Applications of Industrial Gas Turbines, Oct. 28th-Nov. 16th; Course 42, Aero Engine Design, Nov. 25th-Dec. 7th. In 1952, Course 43, Design and Applications of Industrial Gas Turbines, Dec. 31st-Jan. 18th; Course 44, Aero Engine Design, Jan. 28th-Feb. 15th; Course 45, Practical Aero Engine Course, Feb. 25th-March 7th; Course 46, International Course on Aero and Industrial Gas Turbines, March 17th-April 4th; Course 47, Design and Applications of Industrial Gas Turbines, April 15th-May 2nd; Course 48, Aero Engine Design, May 12th-May 30th.



The Brabazon makes a majestic arrival at London Airport.

AIRBORNE in the "BRAB"

Demonstration Flights from London Airport: Good Progress with Mk. I Development

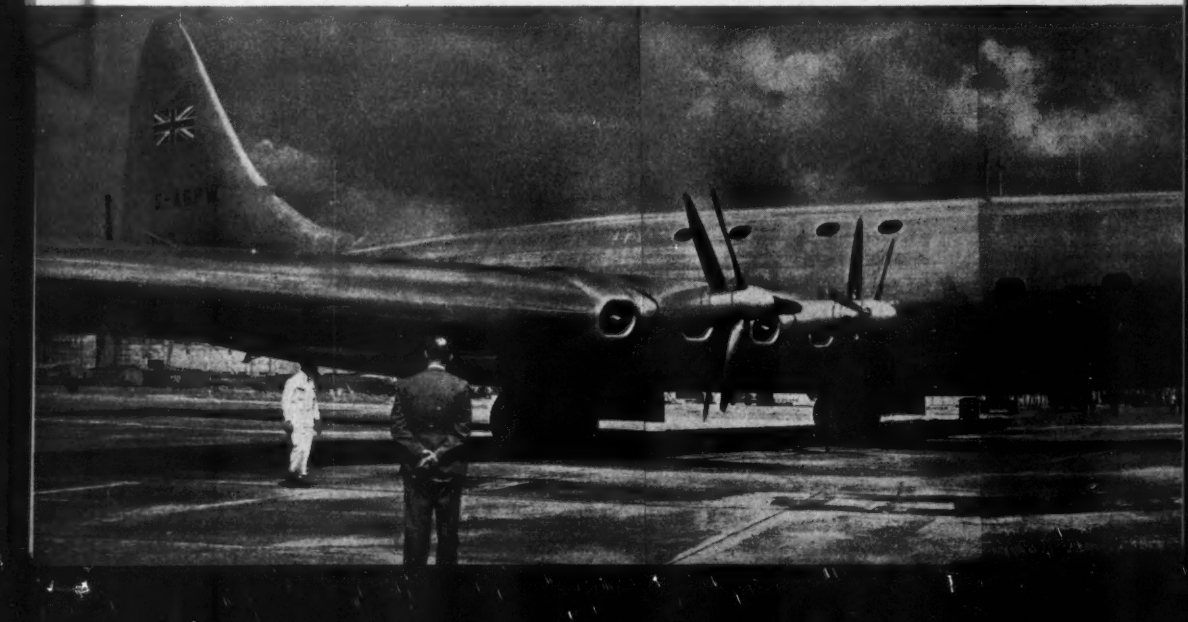
Illustrated with "Flight" Photographs

THOSE who know, and very many more who do not, have for more than two years been assessing, discussing, and arguing about the cost and capabilities of *Brabazon I*, the possibilities of operating her and, in fact, the wisdom or otherwise of having built her at all. During most of this period the great aircraft, oblivious of such talk, has swept majestically through nearly 300 hr of test and development flying, successfully enduring the indignities of stalling and c.g. tests. As a result, a new category of C. of A. has been granted, enabling non-fare-paying passengers to be carried.

Members of *Flight's* staff were among those privileged to fly in *Brabazon I* when she visited London Airport last week, and some impressions are given below. On departure from Filton, the aircraft weighed some 102 tons and carried sufficient fuel for the several demonstration flights and the return to base. The demonstration crew was: A. J. Pegg, chief test pilot, Bristol Aeroplane Co., Ltd. (Capt.); Walter Gibb, co-pilot; L. D. Atkinson, chief flight engineer; G. D. Taylor, second flight engineer; K. A. Fitzgerald, electrical engineer; W. J. Todd, wireless operator; and Douglas Shoemark, flight engineer, engines.

Only the main saloon is furnished, most of the rest of the huge fuselage being devoted to automatic recorders, equipment and water ballast tanks for experimenting with c.g. changes. It is thus fair to say that the noise level in flight is somewhat higher than would be the case if the aircraft were fully fitted out.

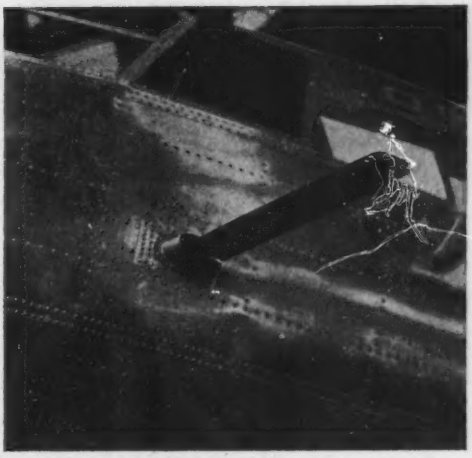
Recently, good progress has been reported with the pressurization and cabin air-conditioning system, and preliminary testing has begun. Ultimately it is planned to give a full differential pressure of 5¼ lb/sq in, and thus maintain at 25,000ft an equivalent cabin altitude of 8,000ft. It is said that under these conditions the length of the Brabazon will



increase by three-quarters of an inch. Pressure is provided by two Godfrey Type-30 Roots blowers, each unit being mounted on the accessory gearbox at the rear of an inner pair of engines. As each gearbox can be driven by either of the engines in the pair, four-engine reliability is provided for the pressurization system. A Normalair automatic controller regulates pressure, and for initial tests the target is 4.1 lb/sq in, or an equivalent cabin altitude of 10,000ft at 23,000ft.

Development of the gust-alleviation equipment is also proceeding well. Response measurements are being made in flight with the detector vane, while the rest of the mechanism is undergoing bench testing. The detector vane itself, of aerofoil section, may be seen protruding from the nose of the fuselage near the captain's station. It registers the effect of gusts a fraction of a second before they reach the mainplane, and the reaction is translated to the ailerons, the position of which will automatically be altered to counteract the effect of the gust, so lessening the strain on the mainplane when flying in rough weather.

Anyone who studied *Brabazon I* closely on her previous visit to London Airport will now note that the large external mass-balances on the rudder and elevators are no longer fitted—an important visual indication of the progress which has been made with controls. The reduction in drag resulting from the removal of these balances is considerable, and the feel of the machine is said to be greatly improved. Indicative of the scale of components on the Brabazon is the fact that the weight saved by removal of the mass balances is equivalent to that of three passengers.



The gust detector vane, seen on the side of the cockpit. Investigation of response in flight has already commenced.

Another experimental fitting seen earlier but now removed is the extended pitot head which projected forward of the nose to a point where the air was undisturbed by the passage of the aircraft. Its removal is understood to have facilitated the installation of a Decca Navigator. Air speed is now measured by the normal pitot heads.

Even if one has inspected the Brabazon at close quarters before, its great size still comes as a surprise. This is particularly true of the interior, the main saloon being reminiscent of one of the larger-type Nissen huts used as mess rooms on R.A.F. dispersal stations.

As the eight paired-Centaurus start up, one by one, a distant rumble, some vibration and a high-pitched drone can be detected. Taxying on runways is unusually smooth, and on take-off it was not possible to tell when the wheels left the ground. The engines have a throaty roar at take-off power, and the noise level is comparable with that heard in current airliners such as the Stratocruiser. When climbing and cruising the sound is more subdued and rumbling.

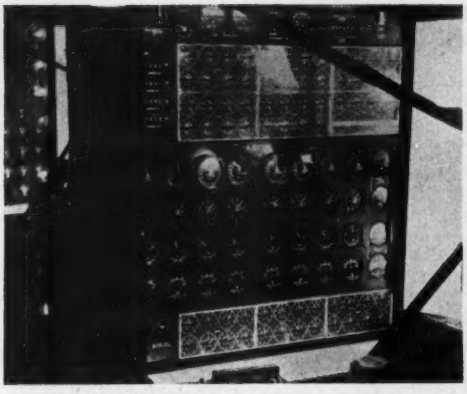
It is most impressive to walk forward along the length of the fuselage; to look out of the windows in each compartment and to see the wings get nearer, then to look down their vast gently-flexing span, to stand abreast the co-axial airscrews, and finally to see them recede until they appear to belong to another machine in formation behind.

One notices the comparatively large aileron deflection used to control the aircraft and, during take-off and landing, the rather unusual movement of the three huge flap sections on each mainplane. These appear to be capable of moving independently and in the fully lowered position present a truly formidable braking surface.

On its passenger demonstration-flight *Brabazon I* was taken on a circuit of London at about 175 kt I.A.S. and 2,075 r.p.m. for the Centaurus engines. The ride was smooth but, frankly, very little different from that experienced in any other large aircraft. Few passengers realised, probably, that the occasional slight shudder was the Brabazon's way of reacting to rough air. The conditions were distinctly bumpy at times, although there was little to indicate this in the aircraft's stately progress.

A wide circuit and very long approach was made on return to Heathrow, and once the wheels had slowly moved down, the speed was kept at around 130 kt. Touch-down speed at the medium weight was 100 kt with the tail far enough down

(Left) An impressive composite photograph of the Brabazon, which manages to convey an idea of its immense proportions. (Above) The pilots at their controls: Mr. "Bill" Pegg and Mr. Walter Gibb.



The panel of one of several large automatic observers installed in the fuselage. Supporting framework for the camera can be seen, right.

A group of passengers embark on No. 4 demonstration flight. The Brabazon seems low on the ground although the stairway indicates otherwise.

AIRBORNE in the "BRAB" . . .

for the attitude to be visible to passengers. The wheels touched so gently that it was almost impossible to tell the moment of contact without looking out of the window, and the run was shortened with the aid of the braking airscrews.

At the controls, Mr. "Bill" Pegg commented that the only one truly manually-operated among all those surrounding his captain's station was that used to adjust his seat. The great majority of engine instruments and controls are to be found at the engineers' stations, the cockpit being neat, orthodox, and relatively simple.

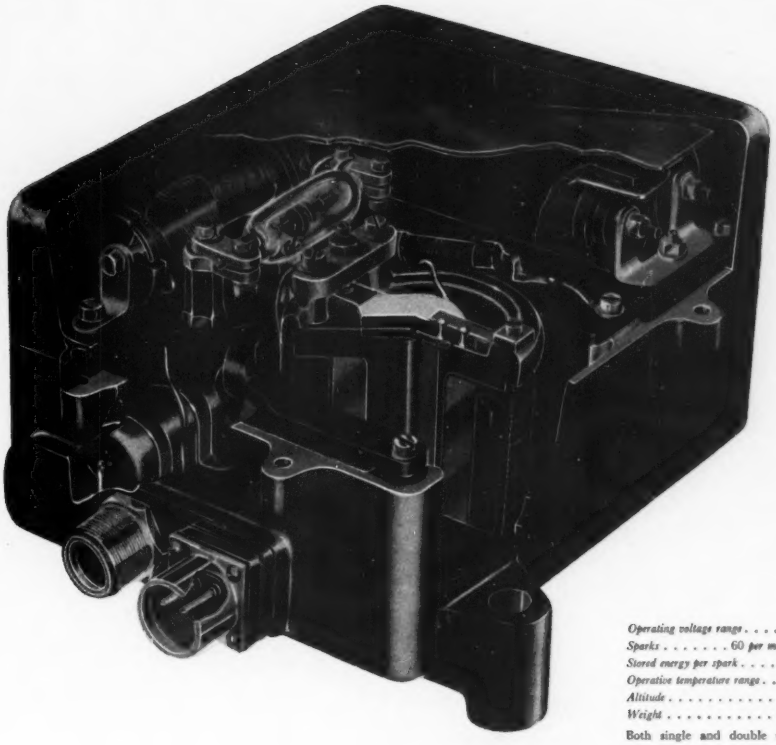
In the coming weeks an unretractable version of a new eight-wheel bogey undercarriage is to be installed temporarily in the Mk I. In this way it will have been extensively tested before incorporation in the Mk II. With the new bogey the Mk II will be able to use any runway strong enough to bear current airliners such as the Stratocruiser.

We may be forgiven for pointing out once more that the Brabazon was designed on the recommendations of the Brabazon Committee to meet the requirements for an airliner to maintain a non-stop service between London and New York. The route distance is 3,450 statute miles but, with reserves, a minimum of 5,500 miles range is required. The Brabazon I Mk I, with Bristol Centaurus piston engines, is the only civil aircraft which will meet this requirement, carrying 100 passengers and a crew of 14. Best cruising conditions are found at 50 per cent engine power and 250 m.p.h. at 25,000ft. Following the prototype is, of course, the Brabazon I Mk II, a developed version fitted with Bristol Proteus turboprops, and this is a type of aircraft which could go into service on the North Atlantic route with a similar load to the Mk I but flying at 350 m.p.h. at 35,000ft. The Bristol company have worked out a schedule for regular non-stop Atlantic crossings with the Mk II aircraft and, assuming that a westerly wind of 70 m.p.h. be blowing steadily for the whole route, it is considered that three aircraft, two operating and one in reserve, could maintain a daily service in each direction. The time-table is, briefly, as follows :—

Sunday:	Depart London Airport midnight. (G.M.T.)
Monday:	Arrive New York 0800 hr. (E.S.T.) Depart New York 1830 hr. (E.S.T.)
Tuesday:	Arrive London Airport 0800 hr. (G.M.T.) Depart London Airport midnight. (G.M.T.)
Wednesday:	Arrive New York 0800 hr. (E.S.T.) Depart New York 1830 hr. (E.S.T.)
Thursday:	Arrive London Airport 0800 hr. (G.M.T.) Depart London Airport midnight. (G.M.T.)
Friday:	Arrive New York 0800 hr. (E.S.T.) Depart New York 1830 hr. (E.S.T.)
Saturday:	Arrive London Airport 0800 hr. (G.M.T.)

Mr. Strauss, the Minister of Supply, who flew on one of the passenger trips over London, pointed out on landing that, at present, there was no intention to put either the Mk I or Mk II in service across the Atlantic. He was convinced, however, that there was "a great future for these big machines."

Bristol directors who were hosts at London Airport are, left to right: Capt. C. Uwins, Mr. W. Masterman (secretary), Mr. G. White, Mr. B. Davidson and Capt. K. J. G. Bartlett.



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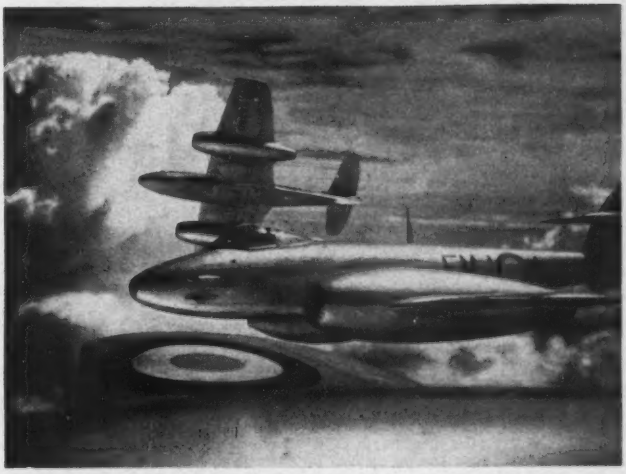


"BREAK STARBOARD, GO—": A Meteor 4 stands smartly "on its ear," revealing the stubby plan-form of its wings and seemingly hanging motionless for a second before falling away from the echelon formation. This fine "peel-off" impression was secured recently as one of a sequence which follows the progress of an R.A.F. recruit through his training.

The Air-minded First Lord

LORD PAKENHAM, recently appointed First Lord of the Admiralty, last week left Northolt in an Avenger and landed on H.M.S. *Illustrious* in the Channel. While his aircraft circled the carrier before landing-on, the First Lord was accorded a 17-gun salute—probably the first ever fired under these circumstances. The First Lord who was paying a visit to Home Command, later left for Yeovilton, Somerset, and Lee-on-Solent, Hants.

Biggin Hill Memorial Chapel

AIR CHIEF MARSHAL LORD DOWDING laid the foundation stone of the new chapel at Biggin Hill last week. A service, conducted by Canon L. Wright, Chaplain-in-Chief, R.A.F., preceded the ceremony. All flying was stopped for the period and the aircraft of Nos. 600 and 615 Squadron, R.Aux.A.F., were drawn up on the runway.

New Ambulance Helicopter

AT the casualty-evacuation exercise held at R.A.F. Moreton-in-Marsh last week the Bristol Sycamore in its new ambulance form was demonstrated for the first time.

The more usual arrangement of employing outboard "pods" in which to carry the patients has been discarded and two stretchers are stowed one above the other athwart the cabin. To provide the extra width required for this arrangement, detachable Perspex blisters are fitted on each side of the fuselage. Should the patients be sitting cases only, the stretcher racks are folded into the side of the aircraft and sufficient room is left to carry three casualties. By the pilot is a swivelling seat for the nursing orderly and a point is provided for the connection of electric blankets.

The exercise lasted the whole week, front-line conditions being reproduced as realistically as possible. A. V-M. J. Kilpatrick, O.B.E., M.B., B.Ch., D.P.H., Director General R.A.F. Medical Services, and A. V-M. W. E. Barnes, M.R.C.S., L.R.C.P., D.T.M. and H., Principal Medical Officer, Home Command, were both present.

FOR SPEEDY SUCCOUR: The Bristol Sycamore helicopter being demonstrated at the air casualty exercises held last week. One of the two blisters for covering the ends of the stretchers lies on the ground. (See "*New Ambulance Helicopter*" on this page).

Military Air Transports

AT question time in the House of Commons recently, Mr. Low (Blackpool North), asked the Secretary of State for Air why he had not requested the Minister of Supply to order aircraft suitable for military transport; and what arrangements he had made with owners of civil transport aircraft to ensure that these were suitable and available for the transport of Army units and equipment, including parachutists.

Mr. Henderson, in a written reply, stated that the Hastings and the Valetta, which were now in service with the Royal Air Force, were suitable for military transport duties. Arrangements had been made between his department, the Ministry of Civil Aviation and the air Corporations to ensure that the resources of the corporations were available in the event of an emergency. No special arrangements had been made with charter companies, except in those cases where it was intended to form auxiliary transport squadrons, but their aircraft could be made available as necessary for the carriage of military personnel and military equipment in war.

Helicopter-deck Ship

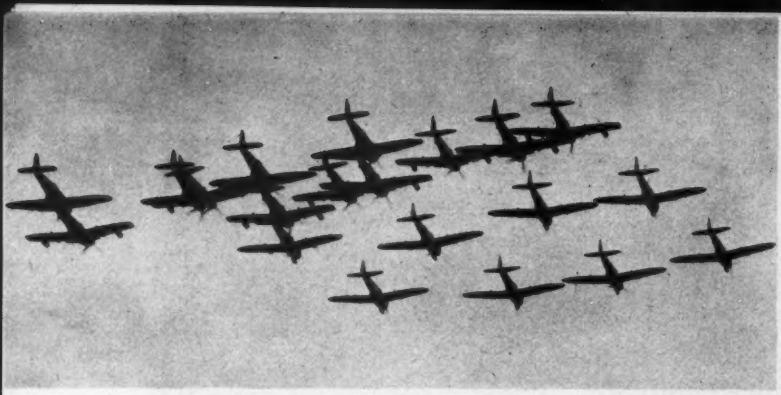
ON Tuesday last the first survey ship to be equipped with a helicopter flight deck, H.M.S. *Vidal*, was due to be launched. The new ship has a length of 315ft and a 40ft beam. The hangar and deck arrangement are so designed as to make possible the safe-flying off and on of a helicopter for air survey photography and the transport of personnel to shore stations.

R.A.F. Appointment

FOR the newly created post of Director of Mechanical Transport and Marine Craft, the appointment has been made of A. Cdre. G. Scarrott—until recently Director of Equipment (B) at the Air Ministry.

R.A.F.A. Broadcasts

SQUADRON LEADER the Marquis de Amodio, chairman of the R.A.F.A. continental committee, has made arrangements with Radio Monte Carlo for a series of broadcasts by members of the R.A.F.A. W/C. Yeo Thomas, G.C., M.C., will give the first talk from 2120 to 2130 hr on August 7th. Capt. Pierre Clostermann will



CONCERTED ITEM: The fly-past of Royal Navy and Royal Netherlands Navy Fireflies and Sea Furies at St. Merryn's "At Home" last Friday. Lt. Cdr. Harris, R.N., led the formation.

SERVICE AVIATION . . .

be the next speaker. Although Radio Monte Carlo is a commercial company, these broadcasts are being given free of cost to the Royal Air Force Association.

Open Day at St. Merryn

FINE weather brought a large number of visitors to the R.N. Air Station, St. Merryn (H.M.S. *Vulture*, Capt. A. C. G. Ermen, R.N.), last Friday, on the occasion of the annual open day and air display. Special interest was added by the presence of No. 1 Carrier Air Group, Royal Netherlands Navy (Lt. Cdr. Bruinsma, R.N.N.). The display opened with a mass take-off, with R.N.N. Sea Furies led by Lt. La Bree, R.N.N. Fireflies led by Lt. Cdr. Leedererken, and R.N. Fireflies led by Lt. Cdr. Harris, R.N. These aircraft also carried out a most realistic attack on the airfield and finished off the display with a really tight formation fly-past followed by a stream landing.

Formation aerobatics by Lts. Martin and Leahy in two Sea Hornets from Culdrose, and a solo effort by Lt. Illingsworth in a Sea Fury, were well up to standard—and the two Sea Hornets, taking off from opposite ends of the runway, brought a gasp from the crowd. Also from Culdrose there was a magnificent display of formation aerobatics by Sea Vampires piloted by Lts. Perrett, Rawbone, Black and Russell.

Air-sea rescue, firefighting, rocket-assisted take-offs and a glider display by Air Cadet Lemin (who trains with the A.T.C. at St. Merryn at week-ends) were all demonstrated.

In addition to the flying programme there was a very complete static exhibition with the theme "Your questions answered" and with a special exhibit showing "Life at a Naval Air Station" (layouts of living quarters, a selection of the 150,000 items available from the Supply Branch, sports, photographic equipment, photographs of the Wrens at work, and so forth).

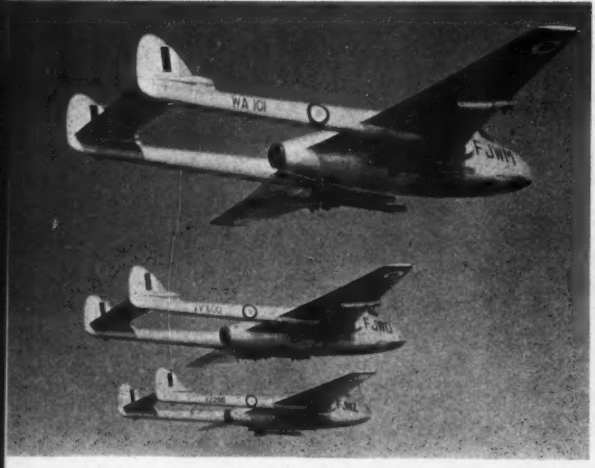
A Gemini, a Proctor and two Austers from Roborough gave flights to visitors when the display was over. These trips were so popular that the airfield, which normally closes down at 1800 hr remained open until 1900 hr, when nearly 60 visitors had to have their money refunded.

Armament Demonstration

ON Thursday of last week staff instructors of the Central Gunnery School at R.A.F. Leconfield gave a demonstration of air weapons over the ranges at Skipsea.

Rocket firing, air-to-ground attack with 20 mm cannon, and dive bombing were carried out from Vampires and Meteors. Lincolns were used to demonstrate rear turret air-to-ground firing, live bombing and air-to-air firing against a flag target towed by a Tempest.

A number of courses at the school are run concurrently:—Course I is for pilot attacker instructors and lasts ten weeks. Cannon firing, R.P. attacks and dive bombing form the most important part of the curriculum. Course II, which also lasts for ten weeks, is for bombing instructors and in Course III, another ten-week course, free gunnery is taught. Course IV is not for instructors but comprises a short (three-week) course for senior pilots from R.A.F. and R.Aux.A.F., to teach marksmanship from jet aircraft. Course V, a junior weapons course for officers, is not in being at the moment, but there is a ten-week aircrew gunner course during which National Servicemen receive instruction in basic gunnery and the handling of turrets. In none of these courses are tactics taught, marksmanship being the main object.



WITH CONCRETE EXAMPLES: Central Gunnery School Vampires, each carrying a load of 25 lb concrete-headed practice rockets, on their way to the ranges at Skipsea.

The C.G.S. is commanded by G/C. D. E. B. Wheeler and W/C. W. G. Moseby, who led the demonstration with rocket firing from a Vampire, is in charge of the flying side of the school.

Service Athletics

AFTER an exciting finish, the R.A.F., by winning the last event of the day, won the Services Athletic Tournament at Portsmouth on July 25th. The final scoring was: R.A.F. 56 points, Army 50 points, Royal Navy 34 points.

Service records were broken by three competitors: A. R. Valentine (Navy) in throwing the hammer 157ft 10in and by F. D. Sando (Army) and G. T. Wright (Navy) who were both inside the Service record in the three-miles team race. Sando's time was 14 min 27.4 sec and Wright was only five yards behind him at the finish.

R.A.F. Win at Lords

A STRONG Royal Air Force eleven, including seven players with county experience, beat the Navy by nine wickets at Lords last week. Totals were:—Navy 303 for eight declared and 178, Air Force 301 for eight and 181 for one wicket (P/O. M. D. Fenner 94 not out). Teams, in batting order, were as follows:—

Royal Navy.—Cdr. G. W. Vavasour, Cdr. R. J. L. Hammond, Lt. Cdr. J. E. Manners, Capt. B. I. S. Gourlay, R.M., Lt. (S) J. M. Vernon, Lt. T. J. D. Grant, Lt. Cdr. J. D. Sayer, S/A. L. Jones, Lt. (E) B. R. Bland, Lt. Cdr. (S) R. H. Martin, Sgt. D. S. Holyoake.

Royal Air Force.—A/C. D. M. W. Heath, P/O. M. D. Fenner, S/L. I. L. Dunn, A/C. J. M. Parks, S/L. R. G. Wilson, A/C. R. Illingworth, F/L. R. Leggett, A/C. F. J. Titmus, L. A/C. E. Fisk, L. A/C. A. B. Moss.

Air Cadets Rally

THREE hundred air cadets from Britain, Canada, Australia, India, Pakistan, Malaya and the U.S.A. will be in camp at White Waltham, Berkshire, this month. A special demonstration and display will take place on Saturday, August 11th.

Benevolent Fund Representatives

THREE appointments of honorary overseas representatives of the R.A.F. Benevolent Fund are announced. Air Chief Marshal Sir Keith R. Park, operating from Auckland, New Zealand, takes over the South Pacific area; in Kenya, A. Cdre. L. T. Pankhurst will represent Nairobi; and S/L. K. R. McCormick will officiate in Mombasa.

Pathfinder Association Benefits

THE Pathfinder Association has made arrangements whereby members of the Pathfinders club, by paying their subscriptions, are automatically entitled to all the benefits of subscribers to King Edward VII's Hospital for Officers. This hospital has not been taken over by the Ministry of Health, but the present maximum charge is ten guineas per week for a private room and seven guineas per week for a ward bed.

Reunions

DETAILS of the sixth reunion of No. 42 Group may be obtained from S/L. H. Morrice Hutt, 170, Upper Woodcote Road, Caversham, Reading, Berks. It is to be held on September 28th, in London.

Nos. 50 and 61 Squadrons are holding a joint reunion in London on November 10th. Particulars from J. Lascelles, 15, Crantock Road, Catford, London, S.E.6.

CIVIL AVIATION

IN PRODUCTION: With an eye on the possibility of future military demands, France is building twelve of these four-engined Bréguet 763 Deux Ponts civil transports. Six of them will be operated on the longer European and North African routes of Air France, and the remainder will be allocated by the French Ministry of Transport.

PROGRESS IN BRITISH CIVIL AVIATION

AT a meeting of the National Civil Aviation Consultative Council on July 26th, the Minister of Civil Aviation, Lord Ogmore, reviewed the progress made during the past year. His review covered all aspects of the Ministry's activities and included the following points of interest.

Associate Agreements : Forty-nine associate agreements are in operation at the present time, of which 19 are for five-year periods.

Flying Clubs : Provision has now been made for British flying clubs to train 300 A.T.C. cadets up to Private Licence standard.

Helicopters : Efforts are being made to ensure that no shortages of machines, landing grounds or pilots will cause delay in the development of scheduled helicopter services.

M.C.A. Airfields : The Ministry is going ahead with plans for the new passenger-handling buildings, the control tower, and the freight building in the new central terminal area at London Airport. At Prestwick, improvements in the main runway should be completed by this autumn and preliminary work on the new subsidiary runway is to proceed as quickly as possible, though it will probably not begin before 1953. Improvements have been almost completed to make Ringway more suitable for Continental traffic, while at Hurn the runways have been strengthened to enable them to be used by Stratocruisers in bad weather. A survey is also being made of the R.A.F. airfield at Rhos, near Cardiff, in view of the limitations of the existing Cardiff Airport.

Runway Visual Range : The introduction of the new black and white markers along the runways of the larger airports has helped to solve the problem of telling pilots with fair accuracy how far ahead they can see when touching down in bad weather.

Airways System and Radar : The Airways System which was brought into operation during the winter of 1950-51 has worked smoothly and is being continuously improved to accommodate turbine-powered aircraft. A long-range radar unit has been established at London Airport for the past eighteen months.

Navigational Aids : In view of the fact that I.C.A.O. has recommended that the Decca Navigator system should be thoroughly evaluated in Europe, the U.K. is supporting Decca to the utmost. B.E.A. is testing it in Europe and one of the developments which has been designed for long overseas routes is to be tested by B.O.A.C. in a Comet.

At the end of his report, Lord Ogmore revealed, also, that a memorial to the two English air pioneers, Sir John Alcock and Sir Arthur Whitten-Brown, who made the first direct air crossing of the Atlantic in 1919, is to be erected at London Airport. An appeal for this purpose will be launched by the Royal Aero Club.

B.E.A.'s STRIKE ENDS

THE 500 supervisors and technicians employed by B.E.A. who took part in a "go-slow" strike last week following a wage dispute, decided to return to normal working conditions after the Minister of Labour had personally intervened. The dispute is estimated to have cost the Corporation about £75,000 and, at the time of going to press, it was thought that normal services would not be resumed for a further three days.

At a meeting on July 24th between representatives of B.E.A., B.O.A.C., and the Association of Supervisory Staffs, Executives and Technicians, it was decided that negotiations should continue directly between the parties involved. It is understood that, in principle at least, the Corporations agreed to concede the union's wage demands.

B.A.C.A. CHANGES ITS NAME

SINCE its inception in August, 1946, the British Air Charter Association has been actively employed in safeguarding the interests of the British independent air transport operators, and in seeking to alleviate some of the difficulties with which these companies are confronted. As serious shortages of aircrew and equipment have led the air transport industry in this country to experience a change in character, and this has brought about a tendency for small companies to close down and the few remaining companies to grow larger, the Association now considers that some readjustment of its scope and constitution has become necessary. In order to meet the altered conditions which now obtain, the British Air Charter Association has decided to embrace all the United Kingdom independent air transport organizations. The title of the British Independent Air Transport Association has been adopted and new members will be sought from amongst companies which, although not strictly engaged on charter operations, are nevertheless concerned in some way with air transport. In addition, a Council has been substituted for the former Executive Committee, and separate committees are also being formed to represent heavy- and light-aircraft operators. Companies having aviation interests, but who are not actually air charter operators, may also apply for affiliate membership.

COMET'S RETURN

FROM Johannesburg the de Havilland Company received a report which indicated that the Comet had been delayed by the suspected failure during a ground run of a small ball-bearing in the alternator cooling fan assembly of No. 4 engine. As it was feared that metallic dust might have found its way into the main lubricating system, and because the facilities at Johannesburg were not considered adequate for the partial stripping of the engine and the cleansing of the lubrication system it was thought wiser to send out a replacement engine. Carried by a York this reached Johannesburg in 30 hours, and took only two hours to install The Comet returned to London Airport on Sunday night, only four minutes behind its E.T.A.

Incidentally, the fourth Comet, G-ALYR, flew for the first time last Saturday; it was piloted by Peter Buggé and Peter Bois.

It is believed that this is the first occasion of any of the Comet's many demonstration and proving flights overseas that it has been delayed by minor engine trouble of this kind.

SILVER CITY'S SUCCESS

FIGURES quoted by British motoring associations indicate that approximately 12 per cent. of all cross-channel car traffic is now being carried by Bristol Freighters of Silver City Airways.

Traffic on the Lympne-Le Touquet car ferry is today much heavier than even the most optimistic forecasts suggested, and has, in fact, reached a density which it was not expected to attain until 1953. An all-out record was achieved last Saturday, when more than 42 round trips were made and over 80 cars carried.

The company is hoping to introduce, next year, an additional service from Shoreham to St. Valery, a crossing of approximately 80 miles.

SOUTH AMERICAN ROUTE INQUIRY

THE Civil Aeronautics Board has announced its intention of undertaking a complete survey of through services between New York and South America. It will review the present arrangements for equipment interchanges between various airlines operating north and south of Miami. Until the survey is complete, two temporary permits given by the Board to National Airlines and Panagra, and to P.A.A. and Panagra to make such interchanges in through services to and from New York, have been set aside. The long-standing agreement between Pan-American and Panagra for service between Miami and Balboa is not affected. Although the industry in general has agreed on the need for a through service between the United States and South America (based on the equipment interchange principle), the C.A.B. does not consider that the airlines involved can reach mutual agreement on a plan of this nature.

In recent arguments before the Board, the W. R. Grace Steamship Company, which owns half of Panagra and has a large interest in National Airlines, was strongly in favour of an interchange

CIVIL AVIATION . . .

agreement. Pan-American, on the other hand (owning the other half of Panagra), was of the opinion that such a scheme would give Grace an exceptionally favourable position by establishing an air service parallel to its shipping routes.

AMERICAN AIRPORT PLAN

A REPORT published by the United States Civil Aeronautics Administration contains the information that almost 5,000 new or improved civil airports are needed throughout American territory to meet the demands of airlines now and in the next three years. Of the 4,945 locations listed, 4,815 are within the continental limits of the United States. The number of completely new airports required is said to be 2,288.

To carry out this national airports plan, expenditure equivalent to some £235 million would be required. It has been suggested that this should be provided in equal proportions by the Government and local authorities. Although most of the airfields are for smaller aircraft on feeder-line routes, 444 of them would actually be trunk airports, including several international terminals. Also in the list are 304 seaplane bases and 83 heliports.

BREVITIES

THE Parliamentary Secretary to the Ministry of Civil Aviation, Mr. F. Beswick, M.P., has appointed Mr. G. Thomas, M.P., to be his Parliamentary Private Secretary.

* * *

After five years as manager of Q.E.A.'s London offices, Mr. J. R. Stewart is returning to Australia to take over the company's offices at Melbourne. Mr. Stewart will be succeeded by Mr. D. K. Maitland, who formerly managed the Melbourne office.

* * *

Special rights have been obtained by the United States Government to carry out maintenance work and provide servicing facilities for American aircraft at Dhahran airfield in Saudi Arabia; the field was originally built by U.S. Army engineers in 1945.

* * *

A meteorological survey of the United Kingdom is now being made by a combined team of investigators from the Air Ministry and the Imperial College of Science. Attention is being directed particularly to the behaviour of air currents over hills and valleys; in this connection, the team is using a radio equipped glider whose course in the vicinity of hills is tracked by theodolites.

* * *

Mr. T. L. E. B. Guinness has resigned from his position as chairman and director of Airwork Limited, owing to his preoccupation with overseas interests. The board has asked him to accept the honorary position of president of the company. Mr. M. D. N. Wyatt, who is at present managing director, will succeed Mr. Guinness as chairman. In addition, Sir Archibald Hope, O.B.E., D.F.C., manager of the commercial department, has been elected a director.

* * *

The volume of business handled by Pan American during the first five months of this year exceeded that of the corresponding period of last year in all categories. The company's net earnings in the year 1950 were reported to have been $4,640,000. At the annual meeting of stockholders at which these results were announced, it was also disclosed that P.A.A. intends to establish a low-cost tourist-class service across the Atlantic not later than October 1st, 1952.

FARNBOROUGH IN MINIATURE: A much-admired exhibit at the recent "Daily Express" display at Hendon was this "S.B.A.C. Show" in model form, contributed by Shawcraft Models. This firm, incidentally, is also constructing a number of models of wartime aircraft for the Battle of Britain film "Angels One Five," now being made at Elstree.

Permission has been granted for the municipal authorities of Hanover to build a civil airport close to the city. At present the airport serving this area is located at Wunsdorf, about 20 miles away.

* * *

A delegation from the Netherlands Government is at present in Australia to negotiate an agreement for the resumption of services by K.L.M. to that country. Present indications are that a bilateral agreement between the two countries is a probability.

* * *

So that airlines may avail themselves of expert servicing and installation facilities without unnecessary delay, Smiths Aircraft Instruments have opened a field service depot at London Airport. At present it will only be operating during normal working hours, although, should the need arise, arrangements can be made to give "round-the-clock" service.

* * *

A contract for the supply of all airfield lighting and allied electrical equipment required at the new Jan Smuts airport at Johannesburg is to be placed with G.E.C., Ltd. High- and low-intensity lighting is being provided on two runways, both of which will also have the British line-and-bar system of approach lighting; the third runway will have low-intensity lighting only.

* * *

The Greek authorities have announced that, although for "traffic purposes" commercial flights to and from Greek territory will still require to be cleared through official channels, all non-traffic flights may now be notified directly by owners or operators without application through the M.C.A. Owners or operators intending to make non-traffic flights are requested, therefore, to advise the Directorate-General of Civil Aviation in Athens, 24 hours before departure.

* * *

The official inquiry into the forced landing in Tangali, East Bengal, of a DC-3 operated by Airways (India), Ltd., last December, resulted in a verdict of "lack of caution on the part of the company" and "gross negligence by its booking section." A wooden crate containing chemicals was found to have emitted fumes, which caused a fire in the luggage compartment; the captain thereupon decided to make a forced landing in a dry river bed. Although none of the occupants was injured in the landing, two passengers and two of the crew died from the effects of the fumes.

LUTON FLYING CLUB "AT HOME"

THE cloudless skies and bright sunshine which graced the eastern half of the country last Sunday morning gave no warning of the sudden thunderstorm which unfortunately marred the afternoon "At Home" organized by the Luton Flying Club. Despite the weather, however, the scheduled programme was maintained. About 10 visiting aircraft (including our own Gemini) reached Luton before the storm broke, one of them (a Messenger, piloted by Mr. K. Matthews-Naper) having flown from Eire, thereby winning the tankard awarded for the longest distance travelled to the rally.

Other tankards were presented to those arriving nearest to a sealed time by air, road and on foot; they were, respectively, A. F. Johnson (Auster G-AIOZ), C. P. Hardy and E. Lavender, the latter, no doubt, having been forced to swim most of the way as the sealed time of arrival for pedestrians coincided with a really torrential downpour. The prize for the *Concours d'Élégance* was won by K. Weininger's smart little Auster, G-AIGT. The club entertained all guests to tea in the clubhouse, and the prizes were presented by the Mayor of Luton.

Shortly after tea the rain cleared sufficiently for visitors to inspect the collection of Percival aircraft (and other types) which comprised a small static display.

THE BIENNE RALLY

Two Weeks Abroad with an Auster : Visits to France, Germany, Switzerland.

So that private owners and club members who were unable to attend the Swiss International Rally last month will learn of a few of the moments they missed, and also to give a general idea of what fun is to be had at these Continental meetings we reproduce the accompanying extracts from an account of the event sent to us by a pilot who took part. He is G/C. R. A. McMurtrie, D.S.O., D.F.C., who, accompanied by his wife, set out on a fortnight's jaunt in his own Auster, taking in visits to Deauville, Paris and the Bienne Rally.

WE cleared Customs at Luton on our outward journey, reached Cap Gris Nez in about an hour, and flew down the French coast to Le Touquet in hazy sunshine. We had tea at the airport but found that we could go on farther and, indeed, preferred to do so, as this is a somewhat over-populated spot which our type of private owner usually tries to avoid.

We decided to stay at Dieppe which, the map showed, had a small airfield three miles from the town and looked more of an honest-to-goodness commercial set-up. It was a grass airfield with a small hangar under construction and a friendly airport manager (known as the 'chief pilot'). Neville Rogers in "Item Willies" was accompanying us, and we parked the two Austers for the night by the farmhouse which served as the airport office.

The 'chief pilot' kindly installed us in his own house, an attractive country inn known as *l'Auberge de la Maison Blanche*. A meal was ready as soon as we had washed and the welcome large bowl of *potage* gave us another homely introduction to the good food of France. After supper we walked in the well-kept garden and saw how our host spent his time when not attending to visiting aircraft. I can strongly recommend this place to anyone who wants to spend a pleasant evening with country food and wine.

In the morning, our host refused to accept any recompense for the use of his car, and the official fee for landing and overnight parking was about one shilling.

We reached Deauville at the appointed time and enjoyed the hospitality and efficient organization which is always found there. After Deauville we had a full four days to fill in before the Swiss rally, so we elected to go to Paris. For Austers, this meant landing at Toussus-le-Noble, which entails a rather long journey to the city. However, we availed ourselves of a handy 'bus service to adjacent Versailles, which enabled us to see one of the 'musts' of Paris; from there a good electric train service runs to the Gare des Invalides. Paris was celebrating its 2,000th anniversary and being warm and gay, offered a pleasant way of spending three spare days.

From Toussus, we set off on Thursday afternoon, having selected in the A.T.C. office, and been cleared for, the airfield at Luxeuil. This was a little farther than we had intended, but we were making for the Belfort Gap and Chaumont was temporarily out of action.

This, like some of our mid-winter experiences in France, proved another case of inadequate briefing. We arrived over the Luxeuil airfield at the end of a long run and saw that the landing 'T' was the wrong way round. There was only one runway so we landed elsewhere on the grass to avoid deliberately landing against the indicated direction. There was no sign of life, except among the few French Air Force types, who ignored us completely. The civil flying club was deserted, and we discovered from a boy that this was the chief pilot's day off and we could not obtain fuel or any other service. Having very little in our tanks, we put the two Austers in the open hangar among the club's aircraft and decided that we had to spend the night at Luxeuil whether we liked it or not. We felt that the airfield information sheet which we had been shown at Toussus might have included one vital piece of information—"No service on Thursdays."

The Quest for Fuel

Next morning the airfield was fully operational but the manager regretted that he could not spare us any petrol. There was of course nothing else that we needed except fuel. This was another case where the club's allocation was insufficient for their own requirements, but when we said we were absolutely stranded unless we got some, we were given enough to take us to the next airfield.

Basle-Mulhouse was reached in time for lunch and there the B.P. tanker met and serviced us as soon as we parked. This international airport, on the borders of France, Germany and Switzerland, provides meals, Customs and all necessary services. It only remained for us to work out as carefully as possible our time of flight to Bienne to enable us to arrive at the allotted time over the stop-watch team at Bozingen airfield. The Royal Aero Club had suggested that we should follow the low ground to Alten, to the south-east of Basle, and then follow the south-westerly valley through Solothurn to our objective. Each participant had to arrive at his own specified time; ours was 3.15 p.m. The only difficulty was to set our watches, and the best we could do at Basle-Mulhouse was to watch the electric repeater-clocks jumping the minutes, or go by the second hand on the A.T.C. officer's wrist watch.

The route was a good one, and we used up the two or three minutes which we had in hand by circling well out of sight of our destination. We thought it would be unfair to fly over the airfield first, and we were about half a minute early as we found the field was rather further north-west of the town than we had previously thought.

A watch error added to this and we were almost a minute before our appointed time over the circle. We did not do what one of our Belgian colleagues was seen to do a little later : he throttled back to try and stretch his run in to use up a few seconds and his Ercoupe just fell out of the sky, to become a complete write-off in the middle of the airfield. The occupants, fortunately, were unhurt. By a most precise piece of navigation, G. Linnell in his Gemini, navigated by B. W. Miller, arrived only 1.6 sec from their appointed time.

We were struck by the clean and modern appearance of the picturesque town of Bienne, cradled between two ridges of hills at the head of a small lake. It is, of course, a bi-lingual town, hence the dual name of Bienne (French) and Biel its German-language equivalent.

Results of the Rally

On Saturday morning, our programme called for a start at 0830 hr. We were driven to two watch factories and later travelled on the funicular railway to Macelin on the hill-top overlooking the town. As soon as they could get us down the funicular again, we were whisked off to the lakeside where our seats were booked on the paddle-boat for the island of St. Pierre. This—the main and busiest day of the rally—ended in a happy mood with dancing on the fore-deck.

Sunday, July 8th, was another fine, warm day. At 0930 the precision landing competition started. It was after this that the Bonanza belonging to the Swiss club was taken off by a member, with three ladies as passengers, and the tank ran dry. The pilot attempted to turn back to the airfield from two or three hundred feet, stalled, and dived into the ground between the airfield and the town. This tragic accident, which was followed by a fire, took the lives of these four Swiss friends and marred the rally.

The results of the arrival and landing competitions were announced at the final official banquet in the evening. First was a Swiss, M. Stocklin (of Zug), who flew a Miles Whitney Straight. G. Linnell and J. Rice, both from Great Britain were second and third, respectively. The prizes, very excellent Swiss watches, were awarded to these competitors; and the remainder (25 in all, received "place" awards) were permitted to select their watches in order of merit.

The prize for *élégance* went to A. J. Linnell's Messenger, G-AKER. The remaining guests, both pilots and passengers, also received watches.

On Tuesday morning we flew by Basle, up the Rhine to Strasbourg, then through Alsace-Lorraine, *via* Saarbrucken, and across the Moselle to Luxemburg. This took us two and a half hours from Bienne, but we then wasted half an hour searching for an airfield which, on my R.A.F. war-time map, was marked in the wrong place. We had seen the new construction going on at the airfield to the east of the town, and in the end this turned out to be our destination. A very fine airport is being made here and the main runway already takes DC-4s on regular Flying Tiger services.

Next day, after making a detour to avoid the Ardenne forests and high ground, we reached Lille, where we found the Customs and refuelling facilities quick and efficient. We were just cleared by 6 p.m. when the Customs finished work, and so took a walk into the adjacent village for a meal, and to buy some wine and olive oil. We had to wait a short while for a thunderstorm to pass before setting out to Lympne, which we eventually managed to reach before dark.

Unfortunately, we had to pay duty on our watches, but this was a trivial price for the hospitality and generosity which we had received abroad. We are certainly looking forward to the next time.

(Above) A general view of the industrious scene at the Derby and Lancs Gliding Club site at Camphill last week as some of the contestants lined up for a winch-launch. (Right) One of the two provisional winners of the individual championship, F/L. R. C. "Jock" Forbes, studies his plan of campaign before taking to the air in his new Slingsby Sky.

National Gliding Championships

Keen Competition for Individual Prizes: Winner Still Undecided

TYPICAL of an unusually exciting atmosphere which characterized the British National Gliding Contests (held at Great Hucklow, Derbyshire, from July 21st to 29th inclusive) is the fact that the scoreboard final markings literally depended on a "photo-finish"—which will be decided only after a microscopic examination of a photograph taken by one of the claimants for first place. If F/L. "Jock" Forbes can convince the judges that his photograph, taken at a turning point, did, in fact, pin-point his position over Flamborough Head during one of the set tasks, he will then have won the individual championship with a total of 877 marks. This would be only four points ahead of Geoffrey Stephenson, who has been provisionally ajudged the winner.

An impressive study in grace and motion is watched by a spectator from the wall which borders the Camphill site on three sides. The machine scudding low over the hillside is one of the London Gliding Club's Eon Olympias. Sixteen machines of this type competed.

Whatever the outcome, however, the results constitute a magnificent testimonial for the new Slingsby Sky sailplane which, although only receiving its C. of A. three days before the competitions, wrested the laurels from the formidable German Weihes by gaining first and second places. Subject to final confirmation, the finishing order was as follows:—

(1) G. R. Stephenson (Sky), 873; (2) F/L. R. C. Forbes (Sky), 843; (3) L. Welch (Weihe), 804; (4) P. A. Wills (Weihe), 800; F. Foster (Rhönbussard), 770; D. H. G. Ince (Eon Olympia), 677.

Stephenson, flying a Sky, had gained an early lead in the contests when, on July 22nd, he made a flight of 76 miles and achieved an altitude of 12,400ft. Two days later (weather caused flying to be cancelled on the 23rd) he followed this by winning a race to Dunstable by one minute from "Jock" Forbes, in another Sky.

Although an out-and-return flight of 93 miles on the 26th gained Stephenson marks, Lorne Welch took the lead at this point with a spectacular distance flight of 187 miles to Manston Airfield in Kent.

The last two days of the championships brought a great improvement in conditions and out-and-return tasks were set. On Saturday, 13 competitors out of 32 succeeded in getting to Boothferry Bridge on the Humber (near Goole—a distance of about 45 miles), but strong head-winds on the return journey prevented anyone from reaching Camphill.

On Sunday conditions were exceptionally good, with up-current strengths often reaching 20ft/sec. Twelve pilots completed a race to Derby airfield (60 miles), the highest speed being clocked by Major A. J. Deane-Drummond, of the Army Gliding Club, who covered the distance in 2 hr 10 min—an average speed of 27.7 m.p.h. Stephenson started late and was unable to complete the return flight, while Forbes, recording a time of 3 hr 18 min, probably earned enough points to overtake the former pilot's total.

The team championship was carried off by the Navy's two Goodhart brothers (Lt. Cdrs. G. A. J. and H. C. N., of the Royal Navy Gliding and Soaring Association); they flew the German-built Mu13 and Meiser respectively. The Eon Cup, awarded for the best performance in an Olympia sailplane, goes to David Ince, who is chief instructor of the Midland Gliding Club.

We hope to publish a more detailed review of the meeting in next week's issue.

Would horses use man power?

At a mass meeting of Little Horses it was unanimously decided that Man as such is an almost useless brute; weak, slow, easily tired, unable to revolve at a decent rate without falling over and liable to get over-oiled on Saturday nights. It was agreed with loud neighs that without horsepower Man would quickly find himself back in the swamps and jungles from which he had been dragged by horsepower and to which he properly belonged.

A Resolution putting Man in his place was just being proposed when our Managing Director arrived and gave the Little Horses such a look! Whereupon the meeting broke up in good order and the Little Horses returned quietly and quickly to work.

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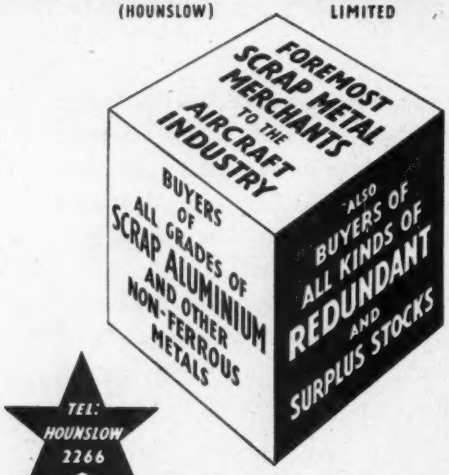
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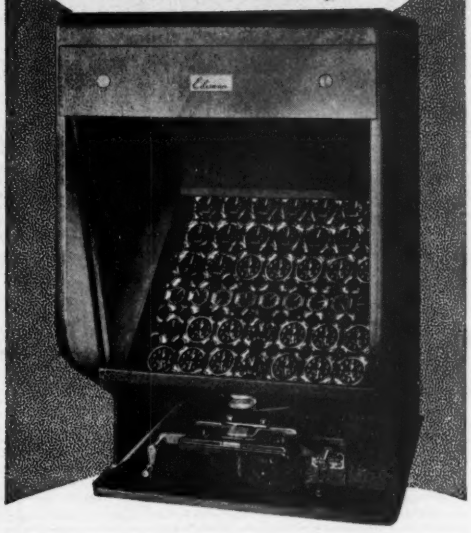

The interpretation of microfilmed records of instruments during test flights is greatly facilitated by use of the Ediswan Microfilm Reader.

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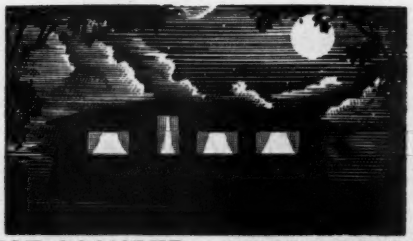

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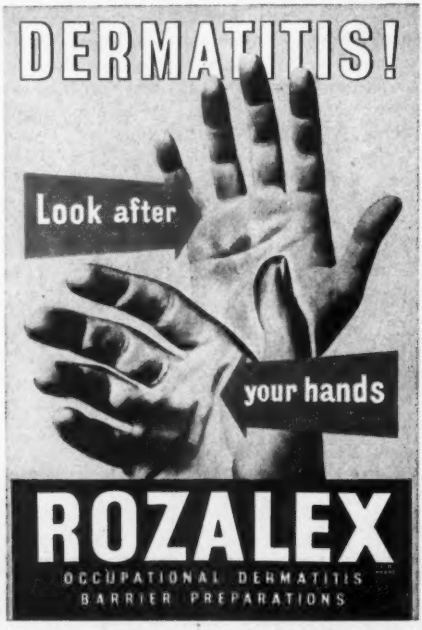

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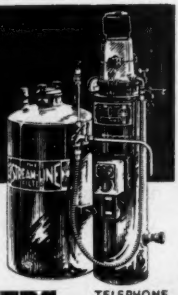

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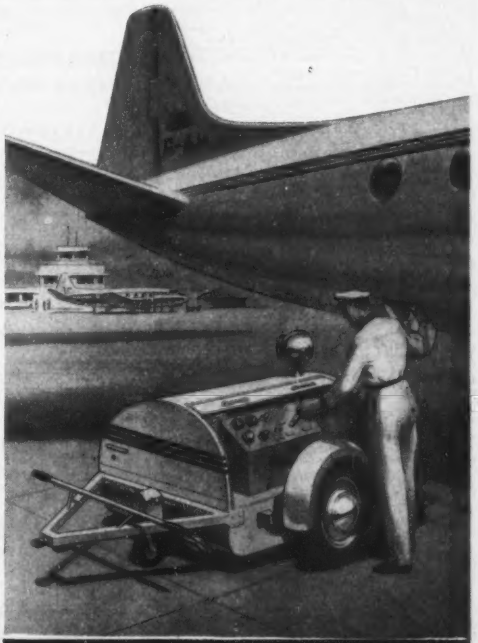

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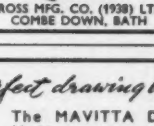

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SITUATIONS VACANT

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VACANCIES exist for air traffic control officers, Grade I, in the Federation of Malaya. Candidates should possess School Certificate, have passed a recognised air traffic control course and possess a Certificate of Competency enabling them to take solo watches in air traffic control centres, aerodrome and water aerodrome control and approach control. They must be between 23 and 35 and preference will be given to those who have aircrew experience, knowledge of civil aviation legislation or radio and radar navigation aids, or a pilot's or navigator's licence. Duties include exercising control for all types of aircraft at land and water aerodromes up to international standards. Appointment on contract for one tour of 3-4 years in first instance. Salary according to qualifications and experience in scale $550 by $35 to $1,150 per annum, plus expatriation allowance of $120 to $231 per annum. Cost of living allowance of between $336 and $707 according to family commitments also payable. On satisfactory completion of contract gratuity is payable at rate of $25 for each completed three months' service (including approved leave) or at $37/10/- for each three months' service on salary of $1,000 per annum or over. Nominal rent charged for Government quarters when available. Free return passages once each tour for officer, wife and up to three children under 10. Local taxes, including income tax, are much lower than in United Kingdom.

Candidates should write, giving brief details of age, qualifications and experience, to Director of Recruitment (Colonial Service), Sanctuary Buildings, Great Smith Street, London, S.W.1, quoting 27230/10. [6728

THE DE HAVILLAND AIRCRAFT Co., Ltd.

HAVE vacancies for

SENIOR design and intermediate draughtsmen (preferably with aircraft experience) in their Hatfield and London (Regent Street) offices.

APPLICATIONS, stating age, experience and salary required, to:—

CHIEF Draughtsman, The de Havilland Aircraft Co., Ltd., Hatfield, Herts. [6533

WESTLAND AIRCRAFT, Ltd., have vacancies for the following:

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TECHNICAL ILLUSTRATORS.

SPARES COMPILERS.

APPLY, stating age, qualifications, experience and salary required, to the Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [6605

A VACANCY exists in the Technical Department for an engineer to assist in work connected with the vibration problems of aircraft.

APPLICATIONS are invited from engineers with suitable experience and mathematical ability.

WRITE, stating age, experience, salary required, etc., to the Personnel Officer, Saunders-Roe, Ltd., East-Cowes, I.O.W. [6643

JIG and tool draughtsmen required. Previous aircraft experience not essential. Pension and life assurance scheme. Apply, Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6548

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Following our recent large-scale offer of five hundred Radio Compass Equipments SCR 269 G, we are pleased to announce that we are able to supply large quantities of the following units utilized in this magnificent installation, as well as being able to provide an excellent coverage of all components.

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1,400 off	Flexible Drive type MC-124.

We are, of course, still able to supply complete compass installations, but due to the tremendous demand being experienced, rather extended delivery dates are the rule.

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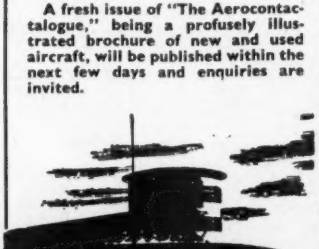

SITUATIONS VACANT

THE DE HAVILLAND ENGINE Co. Ltd., have the following technical vacancies available in the Combustion Research department of their Hatfield factory.

CHEMIST required for work in experimental laboratory engaged on gas turbine research. Educational standard should be at least Higher National, and experience should include gas analysis with some knowledge of fuels and the ability to carry out simple glass blowing operations. Applicants should be able to carry out tests on their own initiative without constant supervision.

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JUNIOR TECHNICAL ASSISTANTS. Technical assistants are required in a laboratory engaged on research in connection with gas turbine components. They should be of at least Higher National standard with a preference for a degree and with some knowledge of either thermodynamics, aerodynamics, or heat transfer. Practical ability is essential and experience of experimental techniques connected with gas flows, combustion or the testing of compressors and turbines would be an advantage.

GOOD salaries and prospects for suitable applicants. Good canteen facilities, 5-day week.—Please write, giving age, full details of previous experience, and salary required, to The Personnel Officer, The de Havilland Engine Co. Ltd., Hatfield Aerodrome, Hatfield, Herts. [6730

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DESIGNER for hydraulic, pneumatic, mechanical accessories such as pumps, servo mechanisms, activators, etc. A senior position with high salary and pension scheme awaits the right applicant, who should be of degree standard with several years' suitable experience, preferably in aircraft engineering.

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DRAUGHTSMEN with experience in mechanical, hydraulic or pneumatic accessories. Ordinary National Certificate desirable but not essential if otherwise suitably experienced.

DRAUGHTSMEN with several years' instrument design experience.

STRESSMAN of degree standard with at least four years' experience in stressing of aircraft structures and with knowledge of materials. Permanent senior position with good salary and pension plan offered to suitable applicant.

HONOURS graduates and graduates with knowledge of supersonic aerodynamics and/or servo mechanism approach to stability.

WRITE full details, qualifications, experience, age, salary sought, to Box AC.6414, Samson Clark's, 57-61, Mortimer Street, London, W.1. [6689

NAVIGATING officers required by Eagle Aviation, Ltd. Minimum qualification: flight navigator's licence.—Apply to Operations, Luton Airport. [6683

LICENSED aircraft radio maintenance engineer required immediately. Please write, Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [6611

AIRCRAFT stressmen required.—Write, stating experience and qualifications, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6552

DESIGNERS and senior and junior draughtsmen for work on gas turbine engines. Midland area. Experience not essential but an advantage. Apply to Armstrong Siddeley Motors, Coventry. [0616

AIRFRAME and engine fitters urgently required. Experience on Mosquito aircraft and Merlin engines an advantage.—Apply in person, or write: Airwork, Ltd., R.N.A.S., Brawdy, Pembs, S. Wales. [6721

ESTIMATORS and rate-fixers required, accustomed to aircraft work, for the south-west area.—Write, giving full particulars, to Box 14035, A.K. Advertising, 212a, Shaftesbury Avenue, W.C.2. [6713

NORMALAIR, Ltd., Yeovil, invite applications from the following for work in connection with aircraft air conditioning, pressurizing, and high-altitude breathing equipment:

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BROOKLANDS AVIATION, Ltd., have vacancies for airframe and engine fitters, electricians for servicing and repair of R.A.F. aircraft. Good wages and piecework bonus.

APPLY: No. 4 Site, Sywell, Northants. [0308

JIG and tool draughtsman required, fully experienced. —Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0563

WANTED, flight engineers for York aircraft. "A" and "C" to cover York aircraft essential.—Apply: Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0610

APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrove, Edgware, Middx. [0075

MALE or female technical illustrator and male technical author required for publications department.—Applications in writing, stating age, experience and salary expected, to Chief Designer, Auster Aircraft, Ltd., Rearsby, Leics. [6704

SITUATIONS VACANT

SCHEDULE clerks required (male), with experience in compiling M.O.S. spares schedules.—Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0595

MECHANICAL, structural or general engineering draughtsman wanted for aircraft work; previous aircraft experience not essential; pension and life assurance scheme.—Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0565

EXPERIENCED airframe fitters required for work on L.P. military metal and composite aircraft. Long contracts. Union rates and bonus. Assisted travel. Canteen, etc.—Apply: Airwork, Ltd., Gatwick Airport, Surrey. [0597

TECHNICAL authors and illustrators required. Knowledge of M.O.S. procedure desirable.—Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds. [0594

GLOSTER AIRCRAFT Co., Ltd., have vacancies for fully experienced aircraft structural and electrical draughtsmen—Applications, in writing, stating age, experience and salary required, to Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [0610

ENGINEER, minimum A. and C. Dakotas for private flight. His Highness, Bhopal, India. Six aircraft. Salary Rs 1,800 per month (£135) plus provident fund. Free bungalow, transport. Preference engineer pilot's "A" or above.—Further details, Box 3022. [0700

REQUIRED immediately, "A" and "C" licensed engineer; some experience approved inspection organisation desirable. Also fitters, airframe and engine, required.—Apply: Air Schools, Ltd., Municipal Aerodrome, Wolverhampton. [0625

DRAUGHTSMEN, intermediate, required, by light mechanical engineers (general and aircraft) for interesting new projects. Prospects and conditions excellent.—Apply: Telefex Products, Ltd. (Aircraft Division), Chadwell Heath, Essex. [0636

TECHNICIAN (male or female) required in the Development Research Laboratory of the Aircraft Division of The Bristol Aeroplane Co., Ltd. Duties include the supervision of a small group of technicians engaged in the testing of materials, rivets, etc.

APPLICANTS should be of Degree or Higher National Certificate standard with preferably some previous experience of this kind of work.

REPLY, stating age and qualifications, to the Personnel Manager, The Bristol Aeroplane Co., Ltd. (Aircraft Division), Filton House, Bristol. [0612

SENIOR weight engineers required. Interesting work on new projects. Permanent positions offered to suitable applicants.—Apply, stating age, experience, qualifications and salary required, to Chief Designer, Gloster Aircraft Co., Ltd., Witcombe, Glos. [0-12

PRESS tool designers are required by large engineering company in the Southampton area. Applications are invited from men with the necessary tool-room and draughting experience. High salary and good prospects for craft with required ability.—Box 4711, A.K. Advertising, 212a, Shaftesbury Avenue, London, W.C.2. [0722

STRESS calculator. Experienced man required by aircraft engineers in Midlands. Must have Higher National Certificate or equivalent qualifications. Excellent prospects for keen and competent man.—State fully details of experience and qualifications, age and salary required, to Box 3023. [0701

DOWTY EQUIPMENT, Ltd., Aircraft Hydraulic Engineers, Arle Court, Cheltenham, require design draughtsmen, preferably with some knowledge of hydraulic and landing gear components for aircraft.—Write: Personnel Manager, giving details of training and experience, and mentioning age and salary range. [0802

AIRCRAFT fitter assemblers required by de Havilland Aircraft Co., Hatfield, offering good working conditions, modern equipment, opportunities for advancement, superannuation scheme, sports club, etc.—Apply by telephone, Hatfield 2345, in person, or by letter addressed to Personnel Manager. [0624

PLANNING engineers (aircraft) required. Considerable production planning experience and sound knowledge of metal airframe components manufacture essential.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0658

TOOL draughtsmen, qualified seniors and juniors required. Varied and interesting projects. Pension scheme. Toolmakers will also be considered for some of the vacancies.—Full details to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting Ref. P.M.2. [0634

INTERNATIONAL AERADIO LIMITED require experienced air traffic control officers for duty abroad. Continuous contracts, free passages, home leave every 2/3 years, kit allowance, local leave annually, pensionable posts. Free quarters provided or allowance in lieu. Minimum income about £700 p.a.—Apply, quoting ATC, Senior Admin. Officer, 40, Park Street, London, W.1. [0726

DRAUGHTSMEN, with experience in high quality light mechanical or hydraulic engineering, are required by progressive Midland manufacturing company. Positions with good prospects are available to younger men. Salaries will be in accordance with age, qualifications and experience.—State details, together with salary required, to Box 3010. [0697

SIR GEORGE GODFREY AND PARTNERS, Ltd., Hampton Road, Hanworth, Middx, have three interesting vacancies for new research eng. (1) A research test supervisor with experience of gas-turbine engines and preferably with an engineering degree. (2) A tester; ex-R.A.F. apprentice suitable. (3) Test observer; an inexperienced lad would suit.—Apply: the Personnel Officer. [0719

SKILLED aircraft maintenance fitter required with basic experience on aircraft engines. Minimum of 8 years' experience in this trade essential; preference given to licence holder, but not essential. Lodging accommodation arrangeable.—Write (quoting Ad. 508), stating age and full details of experience, to Personnel Manager, Pest Control, Ltd., Bourn, Cambridge. [0715

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd. Applications are invited from senior and junior draughtsmen, and stressmen, for work on this interesting programme.—Write, giving details of experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Luton, Beds. [0595

THE GLOSTER AIRCRAFT Co. requires the services of a number of aerodynamicists, (a) for design and project work, and (b) for flight test reduction. Opportunity exists for individuals to vary their experience within the Aerodynamics Department. Candidates with some years' experience preferred, but applications from juniors with sound mathematical ability will receive full consideration.—Apply, in the first instance, giving full particulars of age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote Glos. [0913

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APPLICATIONS are invited from senior and intermediate design draughtsmen: experience of aero engine design desirable but not essential.—Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0449

DEVELOPMENT engineers and senior draughtsmen required with experience in light hydraulic controls and/or fuel metering equipment; also detailing draughtsmen for this type of work. The factory is situated in the grounds of a country house and the wages and conditions are excellent. Hostel available.—Write, Personnel Manager, Dowty Equipment, Ltd., Arle Court, Cheltenham. [0693

THE GLOSTER AIRCRAFT Co. requires senior and intermediate stressmen to work on designs and projects of advanced interest. Excellent prospects of advancement for sound and energetic men.—Apply, in first instance, giving full particulars of technical qualifications, age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote, Glos. [0911

A VACANCY exists in the electronics section of the research department for an electronics engineer, preferably with a degree in mathematics, for the design of equipment for electronic measurement of physical variables and associated problems—Applications, stating age, qualifications, experience and salary required, should be addressed to the Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [0691

BRITISH EUROPEAN AIRWAYS require a junior assistant (weight control). Successful candidate must have reached matriculation standard, will be expected to attain inter-B.Sc. by evening study to undertake more responsible work. Previous experience not essential. Salary scale: £5.17.6 to £7.7.6 per week age 21 years and over. Write full particulars to Personnel Manager, B.E.A., Keyline House, Ruislip, Middlesex. [0727

NORMALAIR, Ltd., invite applications from designers and draughtsmen for work in their London office, in connection with aircraft air-conditioning, pressurising and high altitude breathing equipment. Experience of aircraft equipment or delicate precision mechanisms is essential, only first-class qualified men will be considered.—Applications, stating age, experience, qualifications, and salary required should, in the first instance, be addressed to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [0650

HANDLEY PAGE (READING), Ltd., have vacancies in their design office for senior and junior draughtsmen with aircraft experience. Also required are stressmen, who should have at least two years' experience and with a degree or Higher National Certificate with endorsements in aeronautical subjects. These positions are progressive and offer excellent opportunities to the right men.—Please send full particulars to the Personnel Office, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0601

ELECTRO-HYDRAULICS, Ltd. require a chief electrical engineer to be responsible for the design and development of light electrical equipment for aircraft and other purposes. Applicants should have a first or second class honours degree, have served an apprenticeship, or had similar practical training, and have had some experience of the control of design and development groups. Knowledge of servo systems and aircraft control gear would be an advantage. Apply: Chief Designer, Electro-Hydraulics, Ltd., Warminton. [0725

FLIGHT REFUELLING, Ltd., require a junior stressman and technician for interesting work on experimental aircraft installations. Minimum qualification H.N.C.-(Mech.). Previous experience of aircraft component stress analysis desirable but not essential. Commencing salary in the range £400-£500 p.a., according to qualifications and experience. Five-day 40-hour week. Excellent working conditions. Canteen and sports club.—Apply, stating age, qualifications, experience and salary required, to Personnel Manager, Tarrant Rushton Airfield, near Blandford, Dorset. [0674

BRITISH OVERSEAS AIRWAYS CORPORATION offer opportunities of work on modern air liners to the following tradesmen: electricians, engine and airframe fitters, sheet metal workers and instrument and radio mechanics experienced in the maintenance or overhaul of aircraft and/or components. Rates of pay 2s. 10d. per hour plus 4½d. per hour provisional bonus. Attractive proficiency pay up to 3d. per hour; 5-day, 44-hour week. Possible shift work. Good pension, sick pay and holiday facilities.—Write or call, Staff Manager, Hut 20, London Airport, Feltham, Middlesex. [0800

BRITISH EUROPEAN AIRWAYS invite applicants for indentured craft apprenticeship in the trade of engine airframe fitter. Applicants must be of British nationality, should be 16 years of age on September 1st, 1951 and should have attended a secondary grammar or secondary technical school. They will be required to undergo a course of technical education in addition to an initial period of practical training at the Ministry of Supply establishment or manufacturer's works, with a further period at one of the Corporation's bases. There is no premium; apprentices will receive a wage and whilst away from home a maintenance allowance. Applicants must state details of technical training and any other relevant information, accompanied by a letter of consent from the candidate's parents or guardian and copies of school references. Applications to be addressed to Personnel Manager, B.E.A., Keyline House, Ruislip, Middlesex, must be received by August 10th, 1951. [0724

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[NCC 759L] PLAYER'S NAVY CUT CIGARETTES & TOBACCO

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.: Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office

About Aluminium... 6

MECHANICAL PROPERTIES · *concluded*

IN all metals and alloys, protracted static loading may cause "creep", and repeated dynamic loading, "fatigue"; either of these phenomena can cause failure at quite low nominal stress levels.

Fortunately, the ordinary user of the structural alloys of aluminium is very unlikely to meet creep in practice, and fatigue is usually important only where stress levels are high, as in aircraft structures.

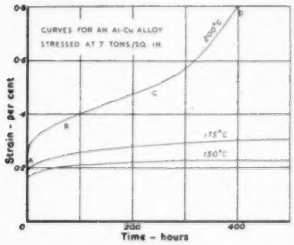
This is one of a series of articles on the characteristics of the metal and its structural alloys, written for the interest of students and others.

Creep

It seems likely that all metals flow under stress, though in the great majority of engineering applications this process is extremely slow at normal temperatures, and can be disregarded.

This is so with the structural alloys of aluminium; only the nearly-pure metal, in its soft state, shows significant creep at room temperature. If the working temperature is raised, however, the creep characteristics of the selected alloy may have to be considered by the designer.

The information available to him is generally the result of tests on tensile specimens subjected to constant stress at a carefully controlled temperature. By loading a number of specimens at different stress levels and constant temperature, or at different temperatures and a constant stress, perhaps for some thousands of hours, a family of curves can be obtained of the form shown in the graph below. In each of these curves, deformation increases in four stages: first elastically, on loading (O to A on the top curve); secondly (A to B), at a decreasing rate; thirdly (B to C), at an almost constant rate, which may be negligibly small at low stresses and temperatures; and lastly (C to D), at an increasing rate which leads to failure. In this example, only the top curve has entered the final stage.



Creep Curves

The designer, faced with a known operating temperature, must limit the working stress to a level at which the final stage of the creep curve will not be entered during the intended life of the product, and at which the total deformation at the end of this time will be within acceptable limits.

It is necessary to curtail ordinary creep tests to a practicable duration, usually to a point where the creep rate has settled down to a steady value. For the aluminium alloys a typical period is 1,000 hours.

Fatigue

When discussing work-hardening in a previous article, mention was made of the internal movements in the structure of plastically deformed metal, which take place as slip in or at the surface of individual crystals.

Even when a metal is stressed within its elastic range, this slip is not entirely absent, though for steady or occasional loading it is quite innocuous. If, however, the load is removed and reapplied (or varied in magnitude) a great number of times, repeated slipping may at length cause a definite separation, or fatigue crack, in the plane of slip. This will spread until the part fails.

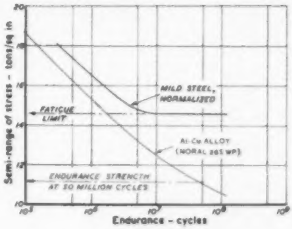
Ability to withstand fatigue may best be determined by repeated loading of the actual part, if this is convenient, but more often standardized test-pieces have to be used. The cycle of loading may be from zero to a predetermined tensile or compressive stress, or consist of a variation about a steady stress, or entail a reversal from tension to compression. Bending, shear, or torsion may be applied instead of (or as well as) tension or compression. In short, an attempt is made to reproduce the conditions of service.

Machines have been developed to apply these various types of loading. A simple and well-known example is the Wöhler machine, in which a cylindrical specimen is arranged as a beam or as a cantilever under a steady load. Rotation of the specimen subjects it to sinusoidally reversed bending.

Unlike creep testing, fatigue testing can be speeded up; the results are not prejudiced until frequencies of the order of 500 cycles per second are approached. This enables many millions of cycles to be applied in a practicable time, and resonance, mechanically or electrically excited, can often be used to save power.

The usual procedure in fatigue testing is to test a number of specimens at different stress levels. By plotting, in each case, the stress against the number of cycles necessary to cause failure, a stress/number (S/N) curve is obtained of the type illustrated below.

It will be seen that the S/N curve for the mild steel flattens out eventually, implying that there is a level of stress below which the material will never fail. This stress is its "fatigue limit." Most of the aluminium alloys, like other non-ferrous metals, do not show this limit (exceptions are provided by the aluminium-magnesium alloys), so it is necessary to quote the maximum stress permissible for a specified life: 50 million cycles is a widely used figure for aluminium alloys.



S/N Curves

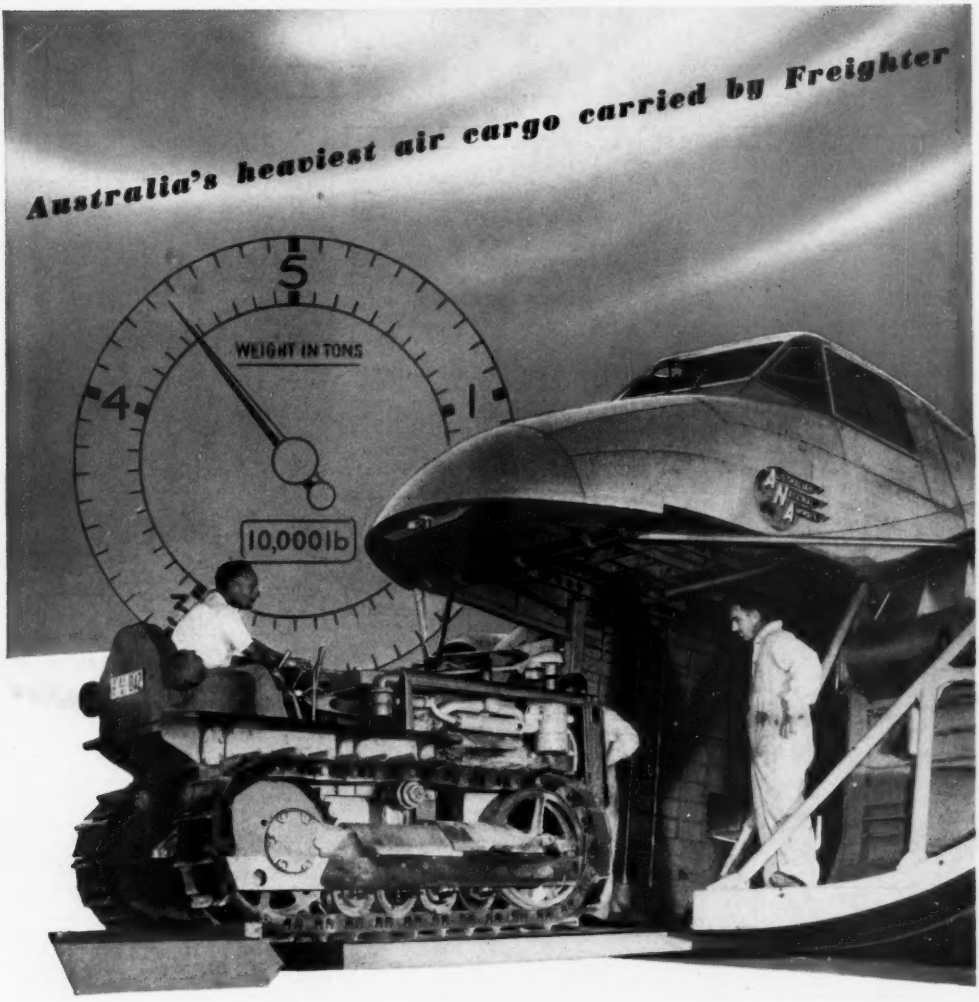
At this number of cycles, the endurance strengths, based on rotating cantilever tests, of two diverse aluminium alloys in extruded form are: Noral 2SM (commercially pure aluminium), 3 tons per sq. in. or 60 % of the U.T.S.; and Noral 26 SWP (a heat treated aluminium-copper alloy), 11 tons per sq. in. or 33 % of the U.T.S. These figures illustrate the tendency of the "fatigue ratio" (endurance strength/U.T.S.) to fall with increasing strength and hardness.

Fatigue resistance may be much reduced by surface irregularities, even machining marks, which, by producing small zones of intensified stress, promote cracking. It is usual, except in tests on actual parts or representations of them, to polish fatigue test-pieces. The designer must, therefore, in using data from conventional fatigue tests, make allowance for the probably inferior form and finish of his product. Improved life can often be realized by shot blasting or otherwise peening surfaces that will be under tensile load, so as to develop residual compressive stresses in the skin.

These discussions are necessarily in general terms, and there is no room to give, except as isolated examples, quantitative properties of the aluminium alloys.

We shall, however, be pleased to send you a copy of our Data Sheet, listing mechanical and physical properties of Noral wrought and cast alloys. When writing, please mention the name of this journal.

NORTHERN ALUMINIUM COMPANY LIMITED
TECHNICAL DEVELOPMENT DIVISION · BANBURY, OXON.



Weighing 10,000 lb. *this tractor was flown by "Bristol" Freighter from Melbourne to Flinders Island and is believed to be the heaviest single piece of cargo ever air-freighted in Australia. A second A.N.A. Freighter flew in other equipment needed on airfield extension work, its cargo comprising a 4,200 lb. scoop, a 2,500 lb. bulldozer blade, a single furrow plough, and over a ton of corrugated iron drains. Figures for A.N.A.'s record air-freight year in 1950 show an increasing reliance on aircraft for the transport of heavy machinery and urgent freight, a development mainly attributable to the "Bristol" Type 170's unrivalled cargo-carrying capabilities.*

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